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RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Vol. 70 JUNE 1958 No. 6

The Angiographic Evaluation of Cerebral Atherosclerosis[1]

MAURICE TATELMAN, M.D.

THE PRESENT REPORT is based on a review of the angiographic studies obtained in a series of 200 consecutive cases admitted to the Cerebral Vascular Service of Detroit Memorial Hospital with the clinical diagnosis of "stroke" or "cerebral vascular accident." Every such case was studied by carotid or vertebral angiography or both. In the earlier cases only the side implicated by clinical and neurological findings was examined, but later, as more knowledge of the processes involved was gained, all cases were studied by bilateral carotid angiography and as many as possible by vertebral angiography as well.

In all cases angiograms were obtained by percutaneous injection (both for carotid and vertebral studies) of 8 to 10 c.c. of 50 per cent Hypaque, in most cases under local anesthesia only. From two to as many as eight injections were given, with but one untoward reaction, an immediate fatality in a sixty-year-old woman who was critically ill with both cerebral vascular symptoms and severe paroxysmal hypertension. Autopsy in this case revealed a very unusual vascular neoplasm which almost completely occluded the main pulmonary artery and the proximal portions of its branches. That angiographic studies are quite safe in these cases is attested by the fact that many of the patients were critically ill, sometimes comatose or semicomatose, and often quite old and debilitated; yet they withstood the procedure without difficulty, with the single exception cited.

It is not necessary at this time to describe the findings obtained on angiography in the numerous and varied pathologic entities which were responsible for the symptoms in this group of patients as indicated by the statistical analysis reported by Webster and Gurdjian elsewhere in this journal (p. 825), since these represent already familiar radiographic entities. The purpose of this report is rather to stress the radiologic manifestations of cerebral atherosclerosis, a subject which has received surprisingly little attention despite the vast literature on cerebral angiography. Some form of cerebral atherosclerosis was found to be the cause of stroke symptoms in 58 per cent of the cases studied.

COMPLETE OCCLUSION OF MAJOR BRANCHES

Internal Carotid Artery: The importance of complete occlusion of the internal carotid artery as a cause of "stroke" symptoms has been well documented (2, 4, 8). Such cases accounted for 10.5 per cent of this series. Most of these occlusions occurred immediately above the origin of the internal carotid artery in the neck (Fig. 1, A) although rarely the obstruction was seen more distally in the neck (Fig. 1, B) or

[1] From the Department of Radiology, Wayne State University College of Medicine, and Detroit Memorial Hospital, Detroit, Mich. Presented as part of a Symposium on Occlusive Cerebrovascular Disease at the Forty-third Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 17–22, 1957.

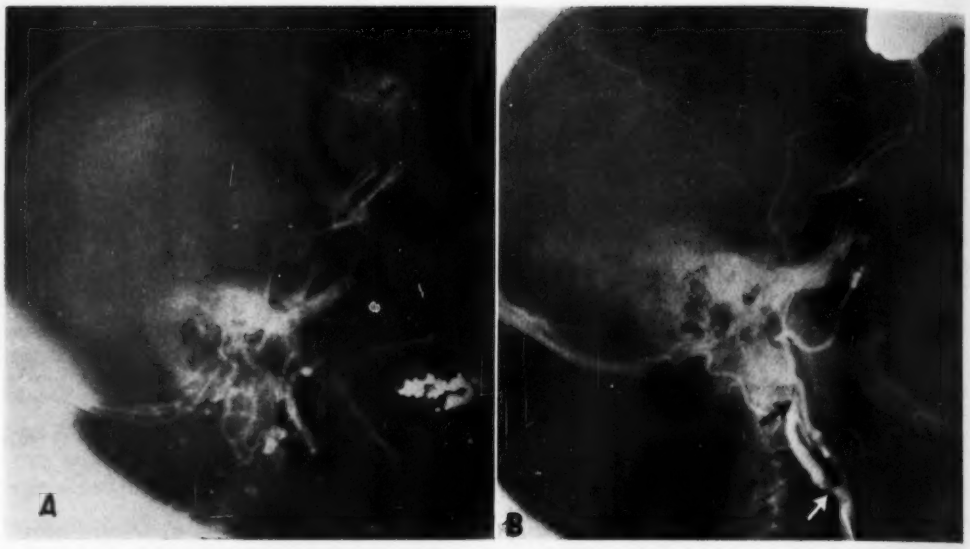

Fig. 1. A. Complete occlusion of the internal carotid artery just above its origin. Good filling of the external carotid branches indicates an adequate injection.
B. Complete occlusion of the internal carotid artery at a higher level in the neck (upper arrow). Note slight narrowing of the internal carotid artery at its origin, with slight post-stenotic dilatation (lower arrow).

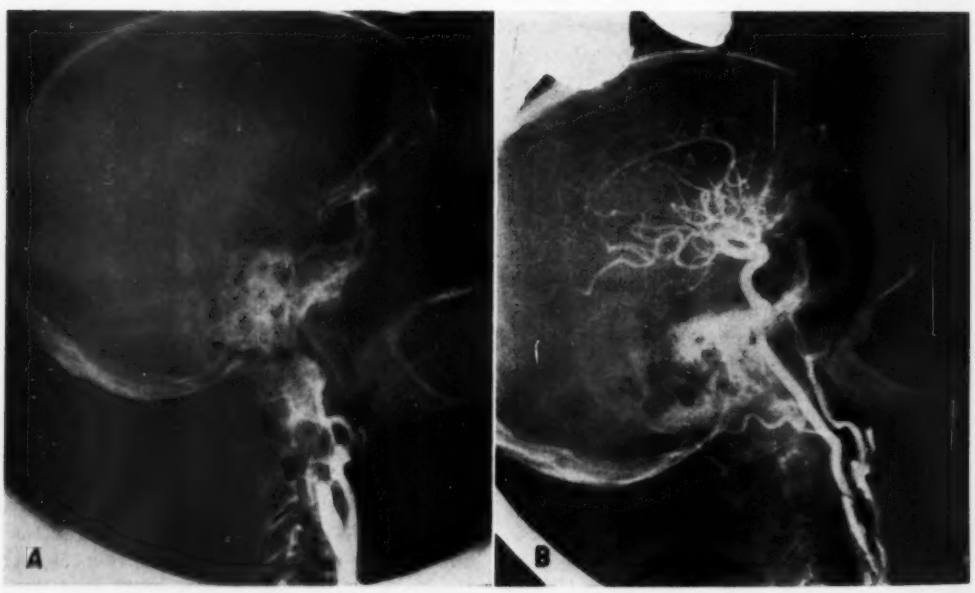

Fig. 2. A. Carotid arteriogram suggesting internal carotid occlusion. The external carotid artery is poorly filled, however, and the needle point is seen to be partly within the wall of the common carotid artery opposite its point of entry, indicating a probable technical artefact.
B. Repeat carotid arteriogram made immediately after A, with re-insertion of the needle at a lower point, proving that there is no occlusion. Some linear defects in the common and internal carotid arteries indicate temporary alterations in the intima due to the trauma of the first injection.

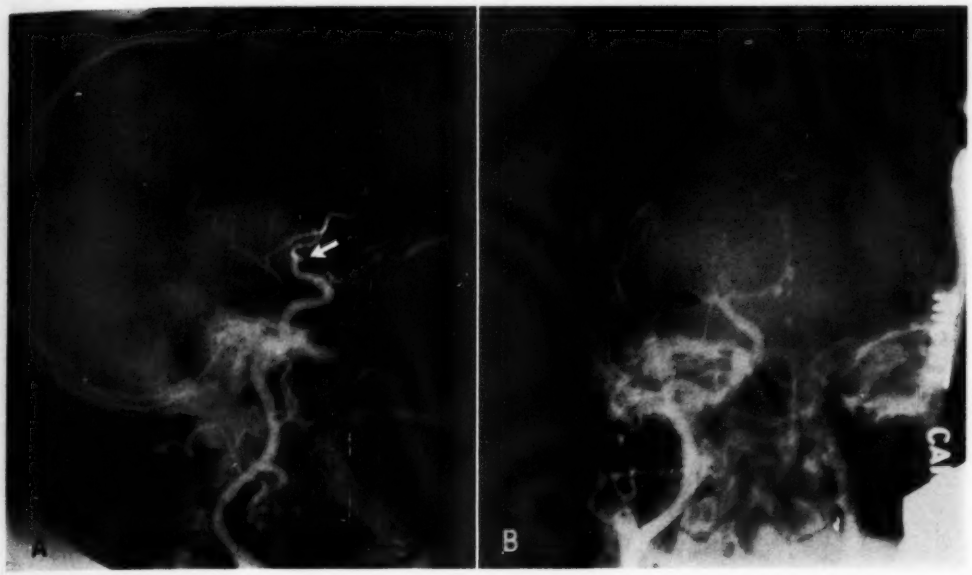

Fig. 3. Complete occlusion of the middle cerebral artery just beyond its point of origin (arrows). Note good filling of the anterior cerebral artery and the external carotid branches, excluding technical injection artefact.

even as high as the region of the carotid siphon. Demonstration of good filling of the external carotid branches usually obviates the need for a repeat injection to test the validity of the nonfilling of the internal carotid artery, especially if the needle point is in the common carotid artery below its bifurcation. Care should be taken, however, to exclude incomplete filling of the artery due to improper placement of the needle, as when it is partly blocked by pressure against the vessel wall (Fig. 2).

Middle Cerebral Artery: The significance of middle cerebral artery occlusion is also well known and there are numerous reports of this condition in the literature (4, 8). Occlusion of this artery accounted for only 4.5 per cent of our 200 "stroke" cases. As in the internal carotid artery, occlusions occurred for the most part close to the origin of the middle cerebral artery (Fig. 3), but were occasionally seen somewhat more distally.

Anterior Cerebral Artery: The frequency of nonfilling of one anterior cerebral artery was quite surprising to us. This was observed in 7.5 per cent of our series. In most instances the block occurred exactly at the point of origin of the anterior cerebral artery (Fig. 4), although sometimes it was found more distally (Fig. 5). The fact that in most of these cases the involved anterior cerebral artery will fill by collateral flow through the anterior communicating artery when the contralateral carotid is injected (Fig. 4, B) has led to the opinion that such findings simply represent some variation in vascular dynamics or a congenital narrowing or absence of the anterior cerebral artery. A review of our series has suggested to us that many, if not all, of these cases are actually caused by atherosclerosis, with either complete occlusion of the vessel or narrowing of its lumen to the point where blood flow is insufficient to allow it to be filled by a contrast injection. The following findings are offered as evidence to support this contention:

1. In all such cases in our series the patients had symptoms of some cerebral abnormality which could not be explained by any other finding.

2. In almost every case characteristic

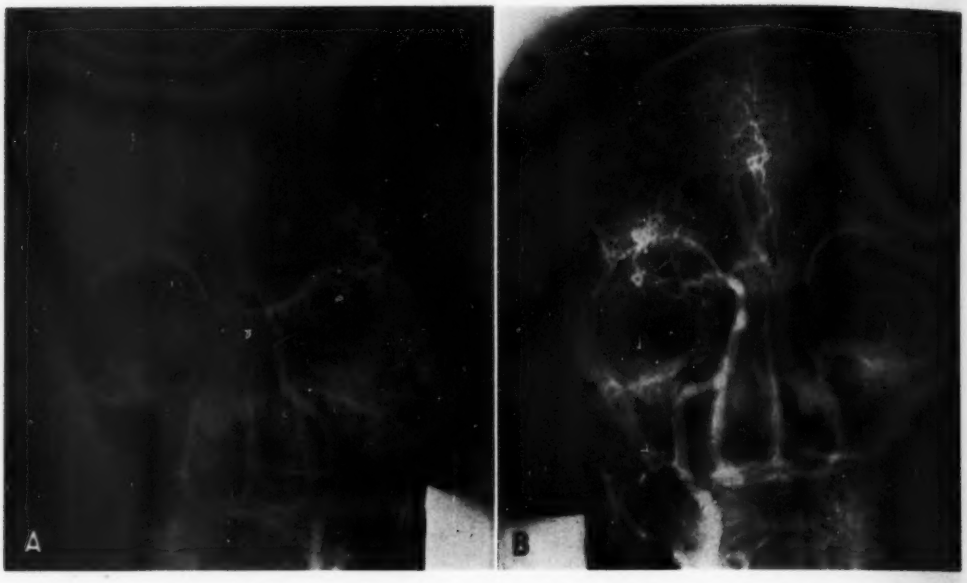

Fig. 4. A. Complete occlusion of the left anterior cerebral artery exactly at its point of origin (arrow).
B. Collateral filling of the left anterior cerebral artery *via* the anterior communicating artery on injection of the right carotid artery. The portion of the left anterior cerebral artery proximal to the anterior communicating artery does not fill, however.

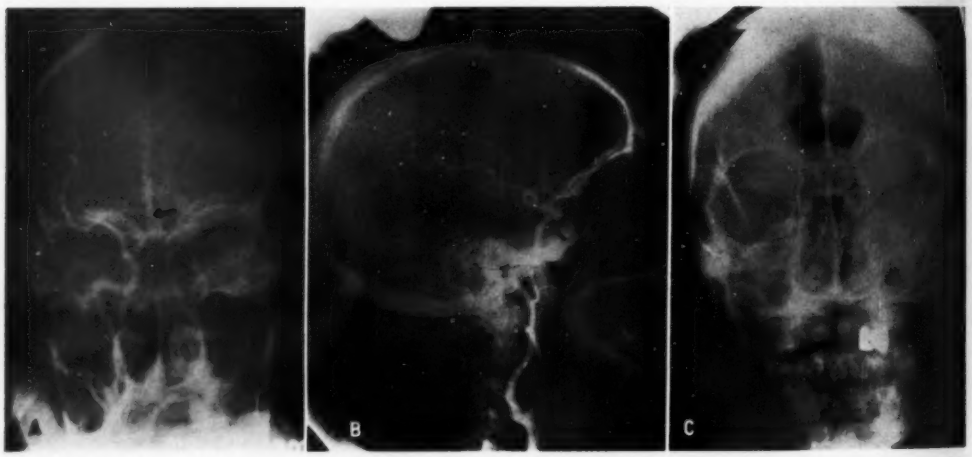

Fig. 5. A. Complete occlusion of the right anterior cerebral artery at the level of the anterior communicating artery (arrow). Note the small caliber of the artery proximal to the occlusion.
B. Lateral projection of same case, again showing absence of filling of the anterior cerebral branches. Note the atherosclerotic plaque in the carotid siphon (arrow) and the generalized dilatation of the internal carotid artery in the neck, indicating general changes of arteriosclerosis.
C. Pneumoencephalogram on same case (anteroposterior view, brow-up), demonstrating localized atrophy in the right frontal lobe area probably caused by infarction in the anterior cerebral artery distribution. Note localized ventricular dilatation and localized enlargement of subarachnoid spaces.

convulsive movements and syncope were produced by digital compression of the contralateral carotid artery (3).

3. In some cases where pneumoencephalography was done there was definite evidence of localized atrophy of the frontal

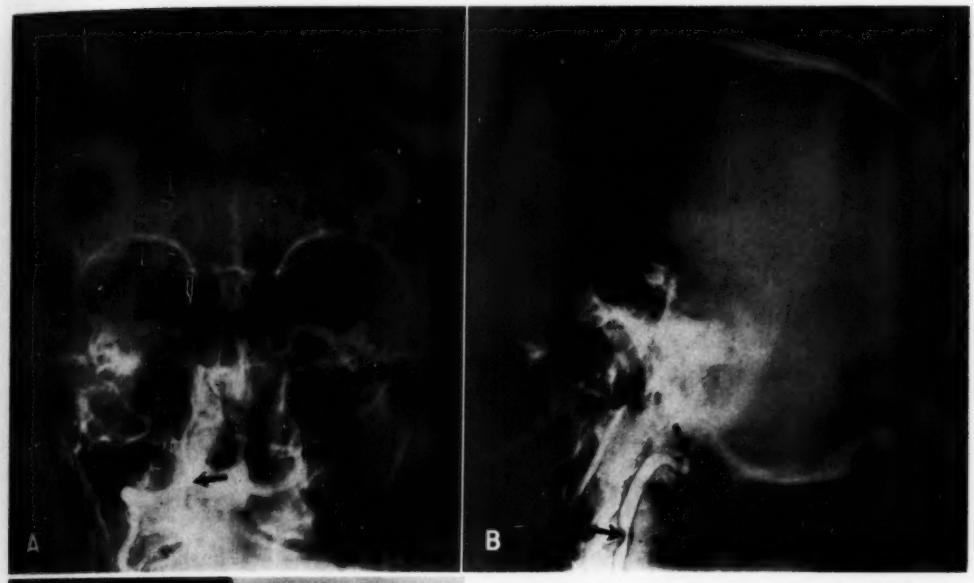

Fig. 6. A. Complete occlusion of the right vertebral artery (arrow). Note collateral filling of the occipital artery.

B. Lateral view of same case (retouched). Point of occlusion more clearly seen (upper arrow). Atherosclerotic plaque in the vertebral artery proximally (arrow) is nearly occluding the vessel at this point. Partial filling of some of the external carotid branches is probably the result of retrograde collateral flow *via* the occipital artery.

C. Injection of the internal carotid artery in the same case demonstrates the upper limit of the thrombotic occlusion of the basilar artery (arrow), as it fills *via* the posterior communicating artery. Note small remnant of contrast material still present at the point of occlusion in the vertebral artery (lower arrow) from the vertebral angiogram which immediately preceded this study.

lobe on the side on which the anterior cerebral artery failed to fill by angiography (Fig. 5, C).

4. The involved anterior cerebral artery could never be filled on repeated injections.

5. Padget (5), in a comprehensive review of the literature on variations in the circle of Willis, has indicated that significant variations in size of the anterior cerebral artery are very uncommon and, furthermore, that such small cerebral arteries are found much more commonly in the older age groups than in the young.

It is obvious that there are many questions still unanswered about the significance of nonfilling of one anterior cerebral artery on angiography, particularly when there is collateral filling from the opposite side. This subject is being pursued further with more detailed investigation. In any event, it is felt that such a finding on angiography is most likely to be of significance whatever the exact mechanism of its production, particularly as it has been shown by Saphir (6) and by Fetterman and Moran (1) that encephalomalacia may be found in

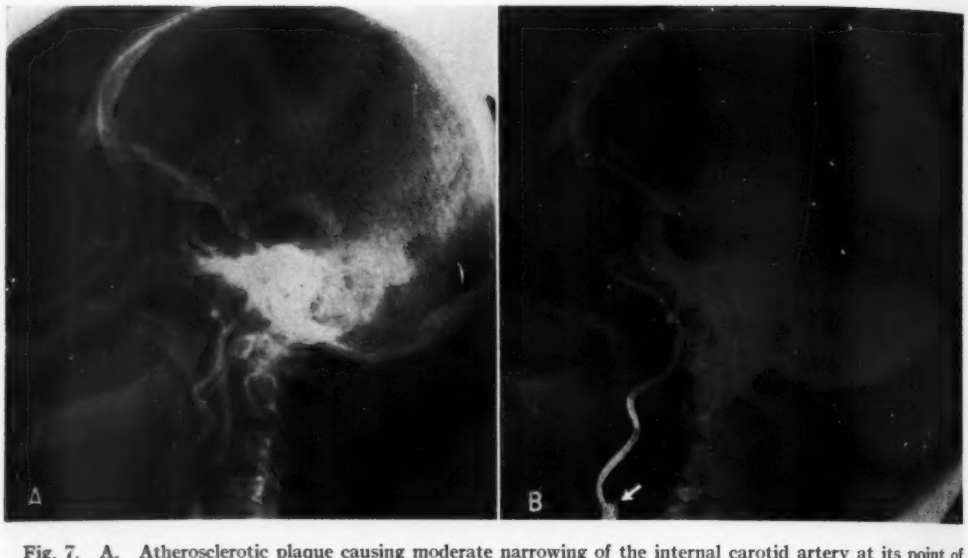

Fig. 7. A. Atherosclerotic plaque causing moderate narrowing of the internal carotid artery at its point of origin (retouched).
B. Eighteen months later the internal carotid artery is completely occluded at the level of the plaque (retouched).

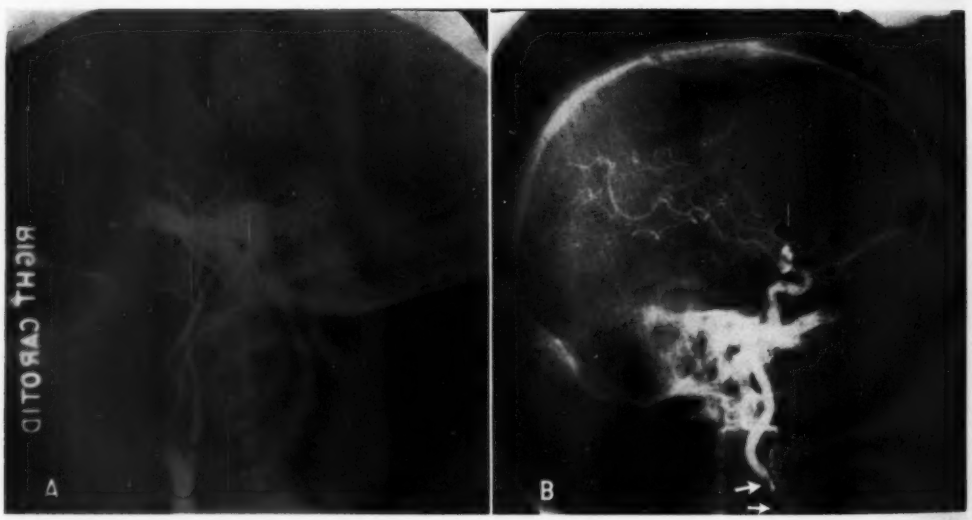

Fig. 8. A. Narrow flap-like atherosclerotic plaque in the internal carotid artery causing marked localized narrowing of the lumen.
B. Atherosclerosis of the internal carotid artery causing a localized segment of fairly symmetrical narrowing (arrows) with slight poststenotic and generalized dilatation of the remainder of the artery.

association with anomalies of the circle of Willis even when there is no actual vascular occlusion. It has been postulated that these patients cannot withstand the decrease in cerebral vascular flow caused by atherosclerosis and minor cardiac decompensation, as might the patient in whom the circle of Willis was intact (6, 7).

Basilar and Vertebral Arteries: Since vertebral angiography is technically more

difficult than carotid angiography, and also somewhat more hazardous, it is not frequently performed, and it is therefore difficult to assess accurately the true incidence of vertebral or basilar artery occlusion. In our series there were 5 cases of occlusion of the vertebral-basilar system, accounting for 2.5 per cent of the total group of "stroke" cases. The occlusion will usually involve the vertebral artery as well as the basilar artery, probably because of propagation of the thrombus (Fig. 6). The upper limit of the thrombotic occlusion may be demonstrated if there is retrograde collateral filling of the basilar artery *via* the posterior communicating artery when the internal carotid artery is injected (Fig. 6, C).

ATHEROSCLEROSIS WITHOUT COMPLETE OCCLUSION

The significance of partial occlusion of the lumen of the internal carotid artery by atherosclerotic plaques has been stressed

Fig. 9. Minor changes of atherosclerosis in the internal carotid artery localized to its origin and to the carotid siphon (arrows). Slight but definite irregularity of atherosclerosis in the anterior cerebral artery (upper arrow).

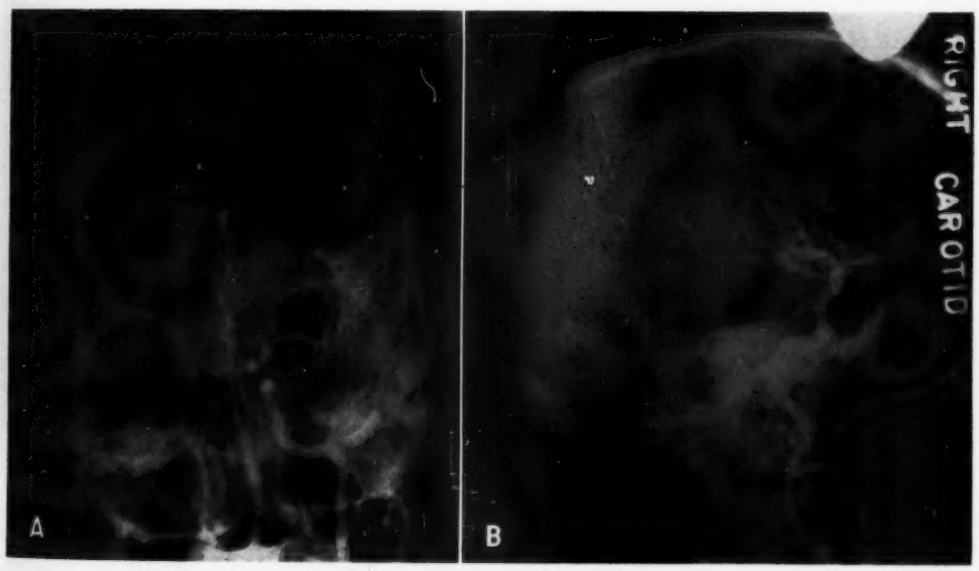

Fig. 10. A. Moderate generalized atherosclerosis of the anterior and middle cerebral arteries in their proximal portions demonstrated by variability in the caliber and slight dilatation. Moderate irregularity is also seen well into the pericallosal branch of the anterior cerebral artery (between arrows).

B. Generalized atherosclerosis of the anterior and middle cerebral arteries, even more generally distributed than in the case shown in A. All of the intracranial branches show some degree of dilatation, abnormal tortuosity, and variation in luminal caliber without significant narrowing. Note the lack of atherosclerotic change in the internal carotid artery.

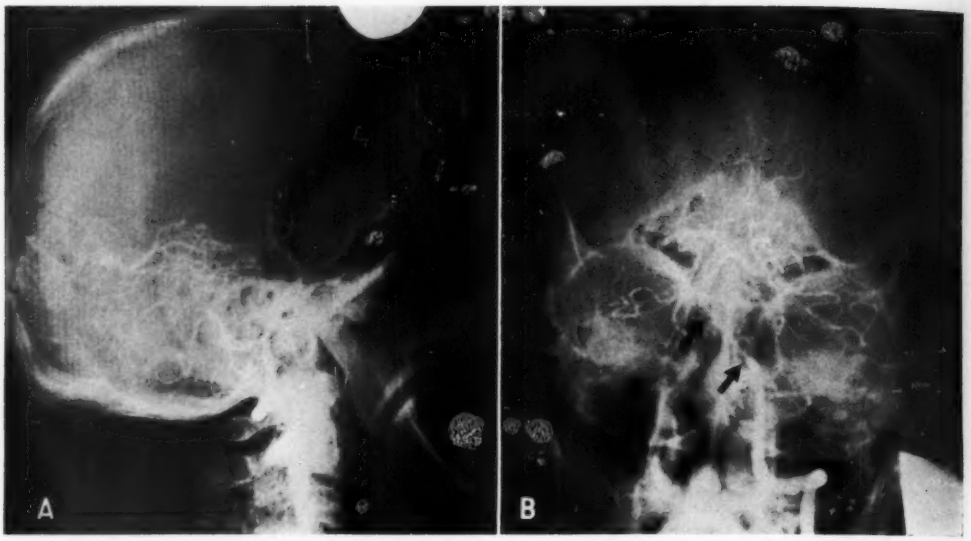

Fig. 11. -A. Atherosclerosis of the vertebral and basilar arteries manifested by elongation of the basilar artery, dilatation, and irregularity of luminal caliber.
B. Anteroposterior view of same case shows to better effect the narrowing and irregularity of the vertebral artery (arrows).

by Webster, Gurdjian, and Martin (8) and is re-emphasized here to indicate the importance of visualization of the area of the bifurcation of the common carotid artery by angiography. Partial occlusion of the internal carotid artery was found to be the cause of "stroke" symptoms in 10 per cent of our patients. The narrowing produced by the plaque is almost always seen immediately distal to the origin of the internal carotid artery and may show a varied roentgen picture—usually an eccentric filling defect in the lumen, most often with a broad base (Fig. 7) but sometimes having an appearance simulating a flap-valve (Fig. 8, A), or less often seen as a symmetrical narrowing of the vessel (Fig. 8, B). The importance of such a finding is emphasized by the fact that a few of these patients have returned after several months or more with complete occlusion of the internal carotid artery at the site of the atheromatous plaque (Fig. 7, B). Such an outcome might be averted in many cases by proper surgical removal of the disease process (8).

Less striking findings of atherosclerosis may be seen, but only with careful study of all of the vessels visualized on cerebral angiography. These are often overlooked because of the small caliber of the vessels but, once appreciated, are found with ever increasing frequency. There is no doubt that such observations are of great significance even when there is no complete occlusion present.

Minor changes of atherosclerosis in the cerebral vessels are similar to those found in arteries elsewhere in the body, namely, irregularity in vessel lumen with or without narrowing, dilatation, abnormal tortuosity, straightening, and elongation of vessels. Slight irregularity in the lumen is found most often in the internal carotid artery just beyond its origin and in the area of the carotid siphon (Figs. 1, B; 5, B; 9). These changes are usually quite localized, whereas the changes in the intracerebral branches tend to be more generalized or involve longer segments of the vessels (Fig. 10).

Atherosclerotic changes in the vertebral and basilar arteries are often quite striking, dilatation and elongation of the basilar artery particularly being not uncommon

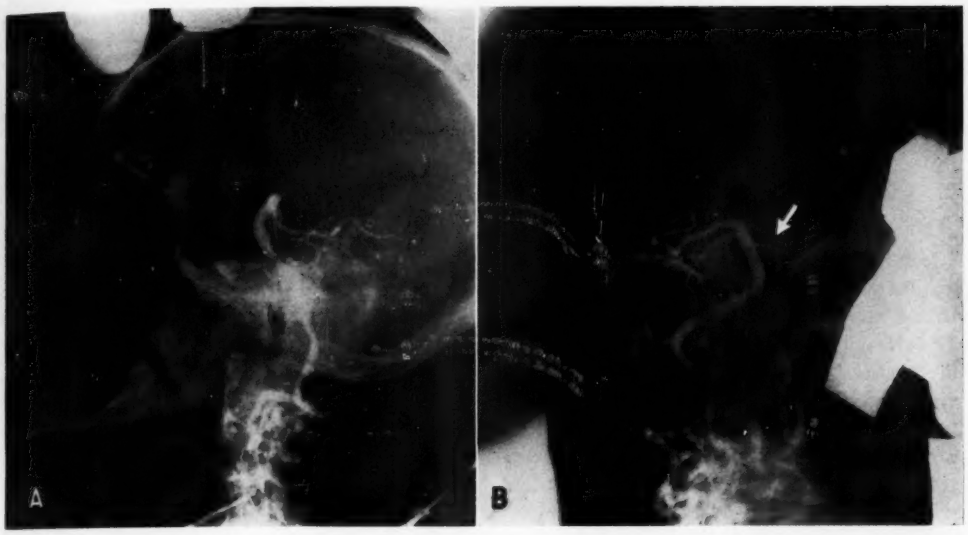

Fig. 12. A. Advanced atherosclerosis of the vertebral and basilar arteries manifested by marked dilatation plus elongation and irregularity in caliber of the vessels. Atherosclerotic changes also involve the posterior cerebral artery throughout most of its course.
B. Anteroposterior view of same case. The small but regular left posterior cerebral artery (arrow) is interpreted as a congenital variant, difference in size of the two posterior cerebral arteries being not uncommon (5).

(Figs. 11 and 12). It is felt that elongation of the basilar artery to a point significantly above the posterior clinoid processes should arouse suspicion of atherosclerotic change even when no narrowing, dilatation, or irregularity is present.

SUMMARY AND CONCLUSIONS

A survey of the angiographic findings in 200 cases of "stroke syndrome" studied by combined clinical, neurological, and radiographic methods has yielded much valuable information as to the etiology of these symptoms. In addition to the more commonly described occlusions of the internal carotid and middle cerebral arteries, the relative frequency of occlusions of the vertebral-basilar artery system and of the anterior cerebral artery is stressed. The angiographic appearance of cerebral atherosclerosis without occlusion is described and the importance of such findings is indicated.

Complete occlusion of the internal carotid artery was encountered in 10.5 per cent of these cases, of the anterior cerebral artery in 7.5 per cent, of the middle cerebral artery in 4.5 per cent, and of the vertebral-basilar arteries in 2.5 per cent. Significant narrowing of the internal carotid artery by an atheromatous lesion without complete occlusion was found in 10 per cent of this series. In all, 58 per cent showed some manifestation of atherosclerosis.

The importance of angiographic evaluation in cases of "stroke" is stressed, with emphasis on the relative safety of such procedures. A plea is made for visualizing the internal carotid artery down to its origin and for examining all vessels carefully for early signs of atherosclerosis.

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SUMMARIO IN INTERLINGUA

Evalutation Angiographic De Atherosclerosis Cerebral

Le examine del constatationes angiographic, obtenite in 200 casos del "syndrome apoplectic" per medio de combinate studios clinic, neurologic, e radiographic, ha producite multe preciose informationes con respecto al etiologia del symptomas in question. A parte le satis communmente describite occlusiones de arterias carotic interne e medio-cerebral, le frequentia relative de occlusiones in le systema arterial vertebro-basilar e in le arteria antero-cerebral debe esser signalate. Es describite le apparentia angiographic de atherosclerosis cerebral sin occlusion. Es indicate le importantia del varie constatationes.

Occlusion complete del arteria carotic interne esseva incontrate in 10,5 pro cento del casos. Pro le arteria antero-cerebral iste cifra esseva 7,5 pro cento, pro le arteria medio-cerebral 4,5 pro cento, e pro le arterias vertebro-basilar 2,5 pro cento. Grados significative de restriction del arteria carotic interne per un lesion atheromatose sin occlusion complete esseva notate in 10 pro cento del casos de iste serie. Un total de 58 pro cento del casos manifestava plus o minus marcate grados de atherosclerosis.

Le importantia del evalutation angiographic in casos de "apoplexia" es sublineate. Le securitate relative del manovras usate in tal casos es signalate. Es recommendate con urgentia extender le visualisation del arteria carotic interne usque a su origine e examinar methodicamente omne le vasos pro signos precoce de atherosclerosis.

Cerebral Infarction Secondary to Occlusive Arterial Disease[1]

J. L. CHASON, M.D.

THE CLASSIFICATION adopted to describe the pathologic changes that occur in central nervous system infarction is that used by pathologists for identical lesions in all the organs of the body. Bland infarcts are of two forms. By far the more common in the central nervous system is the anemic type, in which the scant secondary hemorrhage is limited to the periphery of the area of necrosis. In contrast, in the far less common hemorrhagic infarct, the blood fills all or most of the area destroyed.

The obstructing or occluding arterial lesions that result in the production of infarcts may be divided generally into three types that exist either singly or in combination. These are atherosclerosis of a significant vessel (usually associated with a drop in blood pressure), thrombosis, and embolism. Other causes of vascular occlusive disease are so rare that they will not be included in this discussion.

When an anemic infarct is produced, softening and liquefaction gradually ensue, leading to early and progressive enlargement of the region infarcted. Although the beginnings of these changes are recognizable by the pathologist within six hours, the radiologist is most often confronted with an anemic infarct that is in the second or third week after occurrence. It is at this time that fluid attraction and cell infiltration within the necrotic region can produce a degree of enlargement that may result in the clinical appearance of an expanding mass lesion (Fig. 1). A roentgenogram of the skull taken during this period may disclose a shift of the pineal gland, and pneumoencephalograms a decrease in size of the adjoining arachnoid and ventricular spaces or even displacement of the ventricular system. As is to be expected, these changes are more likely to occur when the area of infarction is large. The diagnostic problems are sometimes compounded by an accompanying papilledema, usually of slight degree, and by signs of temporal lobe herniation (1).

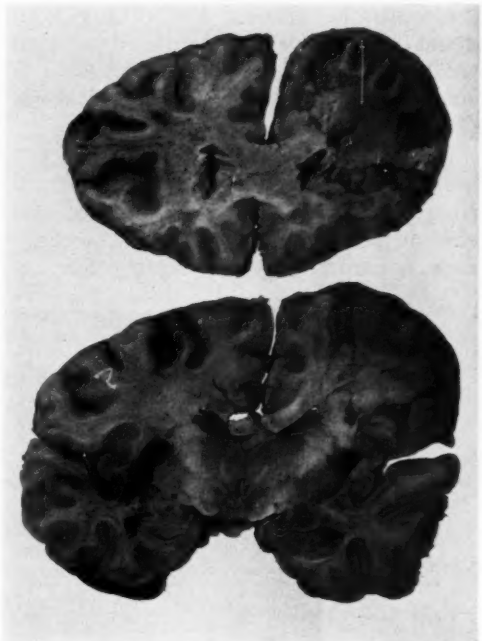

Fig. 1. Anemic infarct early in third week, with compression of adjoining ventricular and subarachnoid spaces.

The period of progressive enlargement ends when the rate of removal of the necrotic contents exceeds the rate of attraction of fluid and reactive cells. This generally begins toward the end of the third week, although with older individuals there may be a slight shift in time toward the right, while in younger individuals the change may occur slightly earlier. The succeeding interval is characterized by a gradual decrease in the size of the infarct accompanied by a focal *ex vacuo* enlarge-

[1] From the Department of Pathology, Wayne State University College of Medicine, Detroit, Mich. Presented as part of a Symposium on Occlusive Cerebrovascular Disease at the Forty-third Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 17–22, 1957.

ment of the adjoining ventricular and subarachnoid spaces.

Ordinarily the lining ependyma remains intact, separating the infarct cavity from the ventricle. Should loss of the ependyma occur, however, a localized ventricular dilatation, sometimes referred to as an acquired porencephalic cyst, will follow (Fig. 2).

The story of hemorrhagic infarction is very similar to that of the anemic infarct, complicated only by the addition of variable degrees of bleeding. The differences may be summarized by stating that enlargement of the hemorrhagic infarct occurs earlier, is of greater degree, and persists for a longer time than in the anemic infarct.

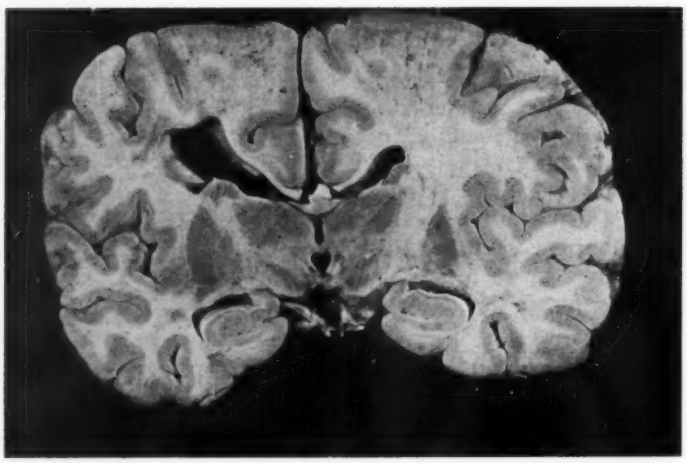

Fig. 2. Porencephalic cyst, right frontal lobe, secondary to remote infarct with destruction of ependyma.

Within the arterial system distal to the obstructing lesion, slowing or cessation of blood flow is accompanied initially by passive engorgement of all vessels, particularly of the capillaries. Some vessels rapidly undergo complete necrosis, while in others it is delayed and follows their emptying by the pressure of the progressively enlarging infarct. Other vessels, because of the collateral circulation, are subjected to an hypoxic state that stimulates hypertrophy and hyperplasia of the endothelial cells (2). In some of these, and in most arteries distal to the occluding lesion, slowing or stagnation of flow either permits the peripheral settling and later organization of platelets and fibrin over the endothelial surfaces (3) or stimulates intimal hyperplasia and hypertrophy (4) (Fig. 3). In either event, the lumens of these vessels are decreased in size and their effective use as collateral channels is thereby impaired.

Another intravascular complication distal to the point of arterial obstruction or occlusion is the occurrence of arterial and capillary emboli within the infarct (Fig. 4). The release of this material from the thrombus, embolus, or rarely from the atherosclerotic plaque, is perhaps abetted by the central pulsatile pressure. The latter is a factor that may explain the greater frequency of the occurrence of these emboli in hypertensive patients. As with the previously mentioned vascular changes, these too can be considered to exert a detrimental influence upon the utilization of the vessels as part of the collateral circulation.

Finally, the well known distal as well as proximal enlargement of the occluding thrombus or embolus and/or the superimposition of a thrombus upon an obstructing atherosclerotic plaque form a further seri-

Fig. 3. Intimal hyperplasia of small artery distal to occluding thrombus. Hematoxylin-eosin. × 90.

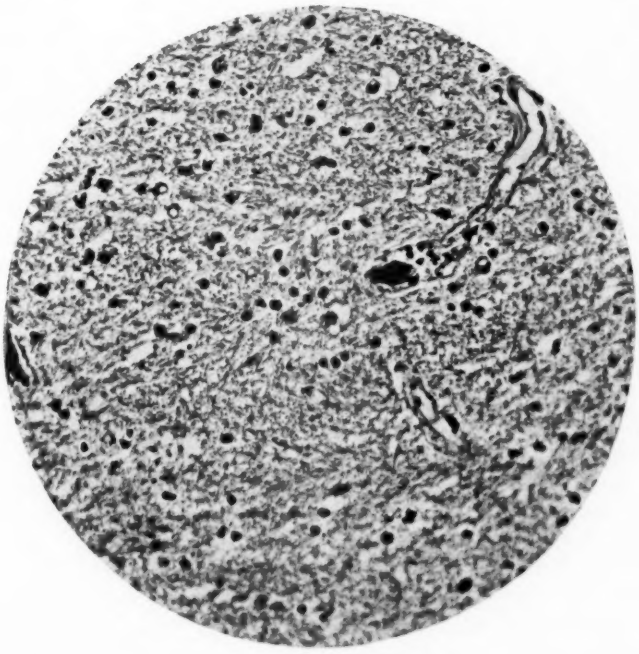

Fig. 4. Capillary embolus from thrombus resulting in recent infarct. Hematoxylin-eosin. × 135

ous threat to the availability of the existing collateral channels.

ACKNOWLEDGMENT: The photograph reproduced in Figure 1 was taken by the Department of Medical Illustration, Veterans Administration Hospital, Dearborn, Mich. The photographs reproduced in Figures 2, 3, and 4 were taken by the Department of Medical Photography, Wayne State University College of Medicine.

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SUMMARIO IN INTERLINGUA

Infarcimento Cerebral, Secundari A Occlusive Morbo Arterial

Infarctos non-infecte occurre in duo formas: anemic e hemorrhagic. Le prime de istos es plus commun in le systema nervose central. Le occlusive lesiones arterial que resulta in infarcimento es de tres typos: atherosclerosis, thrombosis, e embolismo. Quando un infarcto anemic es producite, le region interessate experientia mollification e liquefaction gradual, con le resultato de un prompte e progressive allargamento del region infarcite. Le apparentia assi producite es illo de un expansive lesion de massa. Le periodo de allargamento se termina usualmente verso le fin del tertie septimana. Tunc un reduction gradual in le magnitude del infarcto se initia.

Intra le systema arterial, distal al sito del obstruction, relentamento o cessation del fluxo de sanguine es accompaniate initialmente per un congestion passive de omne vasos. In certes il occurre rapidemente necrosis complete, sed in alteres iste processo es retardate in consequentia de vacuation como resultato de pression per le progresso del infarcto. Altere vasos suffre hypertrophia e hyperplasia del cellulas endothelial, con prejudication de lor efficacia como canales collateral. Un altere complication intravascular, distal al puncto del obstruction, es le occurrentia de embolos arterial e capillar que etiam impedi le utilisation del vasos in le circulation collateral. Un menacia ancora additional al disponibilitate de canales collateral jace in le allargamento de un pre-existente thrombo o embolo e/o in le superimposition de un thrombo super un obstruente placa atherosclerotic.

Theory and Rationale of Anticoagulant Therapy in Occlusive Cerebral Vascular Disease[1]

JOHN S. MEYER, M.D.

SINCE THE REPORT of clinical studies by Wright and McDevitt of Cornell, and Millikan and associates at the Mayo Clinic, it is generally conceded that long-term anticoagulant therapy with heparin and Dicumarol is of benefit in arteriosclerotic thrombosis and occlusion of the internal carotid and basilar arteries associated with intermittent ischemic episodes. Anticoagulant therapy reduces the incidence or abolishes entirely the attacks but does not appear to affect significantly the course of severe infarction once it has occurred. The use of this type of treatment has however been empirical. The present report is concerned with an investigation of the action of anticoagulant drugs in experimental cerebral vascular disease.

It is common clinical experience that in man the use of anticoagulants in occlusive cerebral vascular disease produces rapid improvement within a few days or weeks. At first, this was thought to be due to recanalization of the occluded vessel. In 2 patients, however, with occlusion of the internal carotid artery, angiography was repeated after three to five weeks of anticoagulation therapy, during which time clinical improvement had occurred, in order to see if the obstruction had been altered by treatment. In one, the vessel had become partially patent, but in the other, a man with bilateral carotid artery occlusion, there was no evidence of recanalization in spite of clinical improvement (Fig. 1).

An alternative possibility is that anticoagulant drugs in some way improve the collateral circulation supplied by small arterial anastomoses after occlusion of a major cerebral vessel. In order to examine this proposition, the middle cerebral artery was occluded, with aseptic technic, in 23 monkeys and 11 cats. In half these animals no anticoagulant drugs were used and in the other half coagulation was suppressed with either heparin or Dicumarol so that the clotting time was maintained between forty and ninety minutes and the prothrombin time between forty and eighty seconds, respectively. In order to produce severe ischemia or infarction, the blood pressure was lowered at the time the middle cerebral artery was occluded. Occlusion was accomplished by the application of two silver clips after turning a bone flap. A sterile modified Forbes window was then screwed into the bone flap so that the ischemic territory could be viewed from day to day with a high-power microscope and macrophotographs were taken with a camera designed for this purpose (Figs. 2-4).

In some animals 8 ml. of a saturated solution of trypan blue was injected intravenously at various times within the first seventy-two hours after occlusion in order to demonstrate any change in vascular permeability. In others 10 to 15 ml. of filtered India ink was injected slowly into the femoral vein to indicate any tendency toward agglutination of small particles. In a few additional experiments methylene blue was introduced intravenously in order to reveal possible localized changes in plasma concentration.

Measurements of oxygen tension were made by the polarographic method, with sterile platinum electrodes that could be inserted through specially designed ports in the rim of the Forbes window.

With magnification above 100 ×, it was possible to observe and photograph capillaries and to identify individual blood cells and platelets in zones of stagnant flow.

In normal cortex the flow of blood within vessels was rapid, and individual blood cells could not be identified. An axial flow

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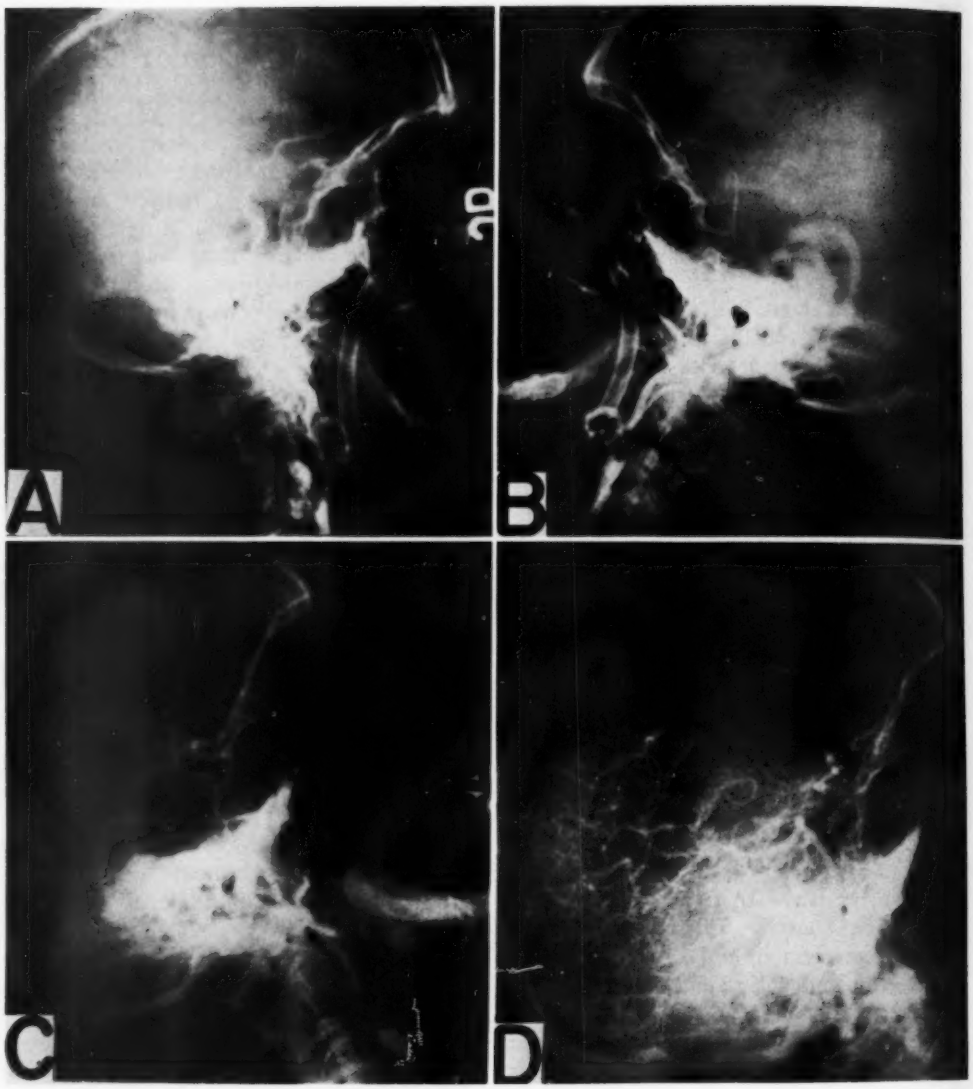

Fig. 1. A and B. Arteriograms of a 51-year-old male with bilateral occlusion of the internal carotid arteries in the neck, resulting in bilateral hemiplegia and coma.

C and D. Right carotid and vertebral arteriograms after five weeks of Dicumarol therapy, at which time the patient was much improved, with appropriate speech and a residual right hemiparesis. Comparison of C with A shows that 1 cm. of the obstruction has been removed, but the internal carotid is totally occluded. The vertebral arteriogram shows remarkable filling of all cerebral vessels due to the development of collateral circulation *via* the *posterior* cerebral arteries.

of blood was present in all vessels so that a thin line of clear plasma was seen next to the wall. Arteries were a bright orange-red in color and veins a dusky red. The intravenous injection of India ink resulted in a faint gray coloration of the plasma, but individual carbon particles were not recognizable.

Occlusion of the middle cerebral artery in the presence of a low blood pressure resulted in failure of the collateral circulation to compensate, and severe circulatory

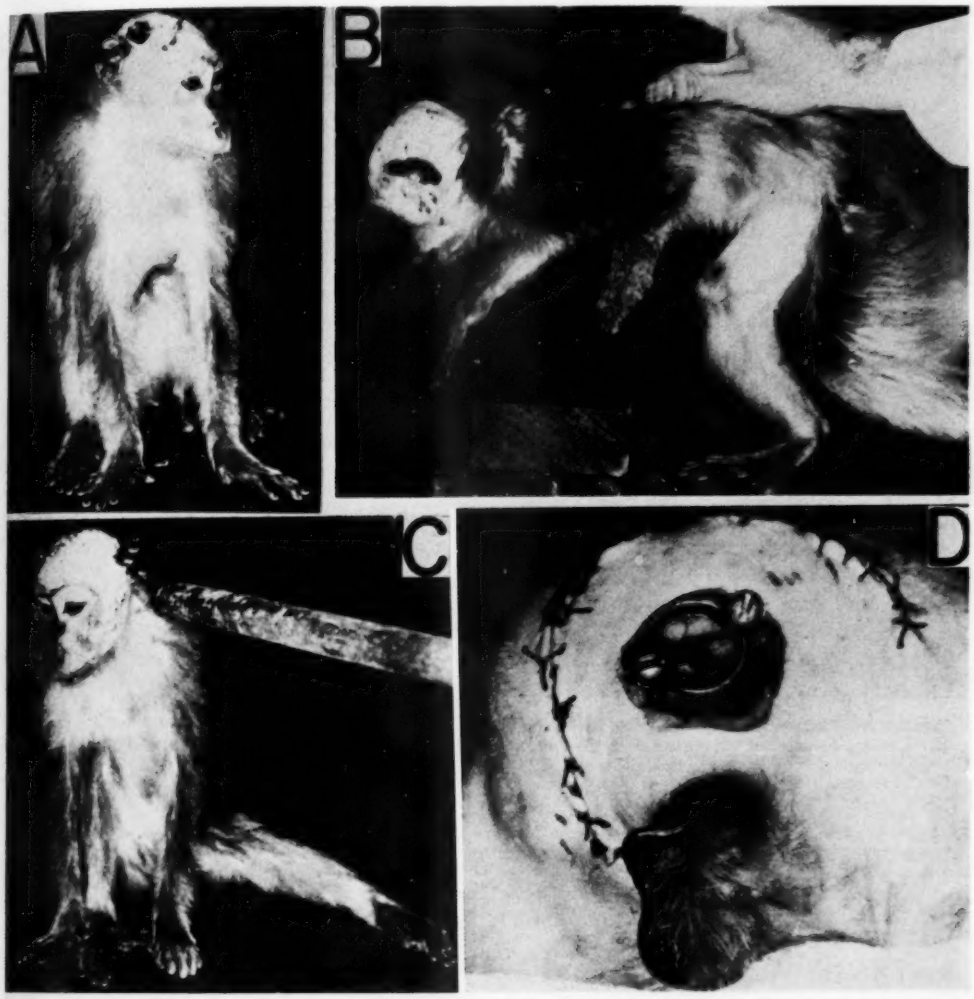

Fig. 2. Forbes window in place after occlusion of the middle cerebral artery. A. The unanesthetized animal with window in right parietal area. B. To show absence of hopping and placing reactions in left limbs. C. To show left homonymous hemianopia. D. Close-up view of cerebral cortex in ischemic zone.

changes appeared in the cortex. The first change was pallor due to collapse of small arterioles and venules; the cortex appeared pale and cyanotic due to a blue-black coloration of terminal venules and dusky brown arterioles. After fifteen to thirty minutes, swelling of the brain developed, with widening of gyri and obliteration of sulci. The oxygen tension of the cortex was reduced to between 5 and 20 per cent of normal.

Red cells became adherent to one another and in the veins formed large clumped masses. White cells then began to adhere to the walls of the venules and further obstruct the passage of red cells by narrowing the lumen (Fig. 5). The intravenous injection of methylene blue at this time demonstrated that hemoconcentration was occurring in the terminal venules within the ischemic area, for the dye became concentrated within these vessels, giving the plasma a dark blue color. If trypan blue was injected in addition to the methylene

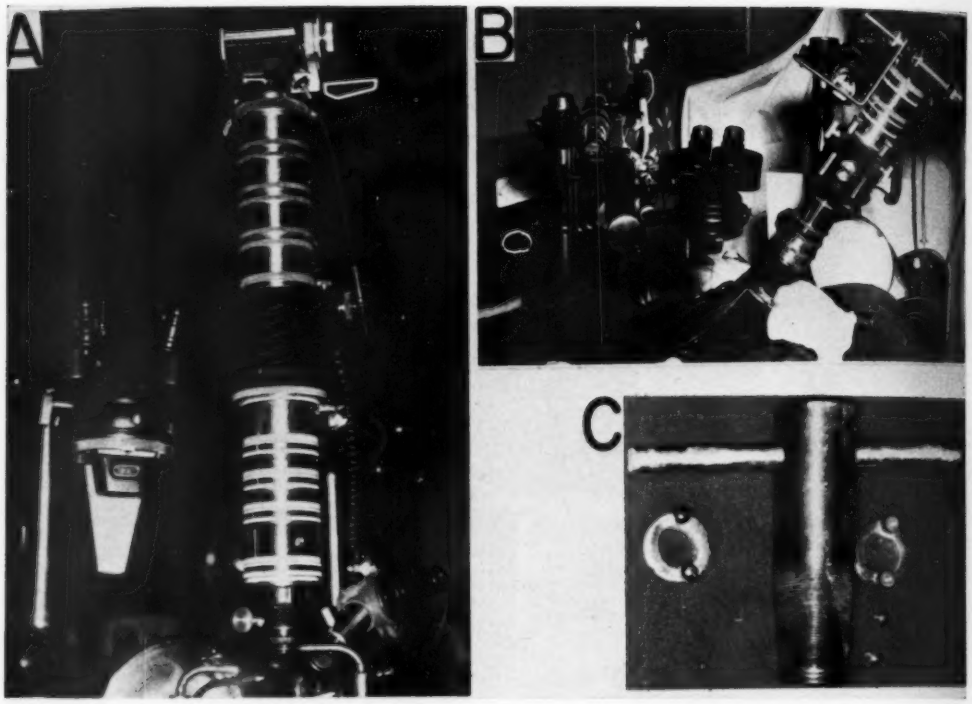

Fig. 3. A. Camera and binocular microscope used for examination of the pial circulation.
B. Camera focused on the cortex after the middle cerebral artery has been occluded and the window placed in the skull aseptically.
Skull tap and windows.

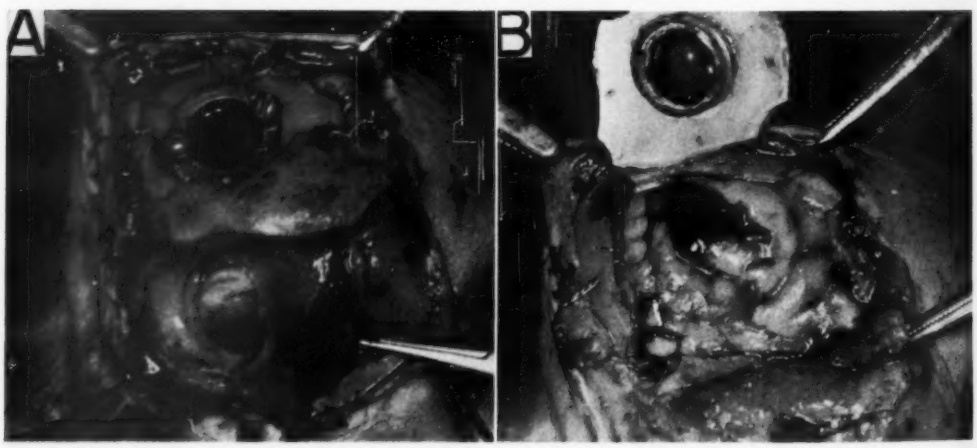

Fig. 4. Placement of Forbes window at autopsy of an animal dying of extensive infarction following occlusion of the middle cerebral artery.
A. The scalp and galeal flaps have been reflected and the bone flap with window is shown wired into position.
B. The bone flap is elevated to show swollen hemorrhagic infarct beneath.

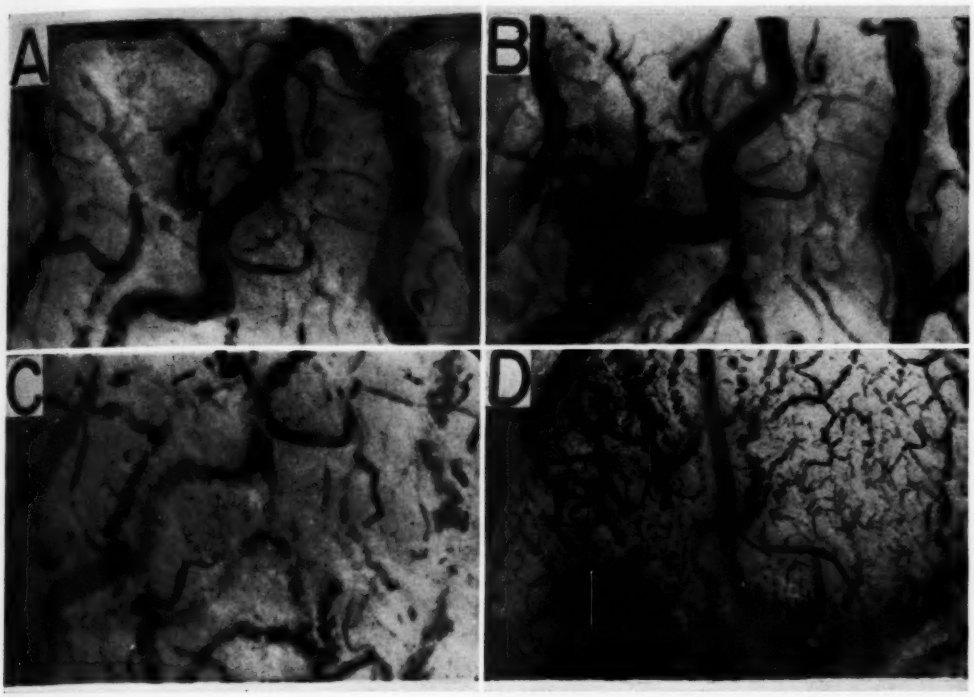

Fig. 5. Four microphotographs of the same field in the parietal cortex of the cat to show localized circulatory changes following occlusion of the middle cerebral artery and its principal collateral vessels.
A. One hour after occlusion there is margination of white cells, which are sticking to vessel walls. Red cells are beginning to clump in terminal venules (×60).
B. Two hours later white cells and platelets are adhering to vessel walls and clumped red cells are causing segmentation of flow (×60).
C. Three hours later. Filtered India ink has been injected intravenously and carbon particles are clumping.
D. Same field, ten minutes later, at lower magnification, to show large black clumps of agglutinated carbon particles. Gray clumps are masses of red cells. Agglutination of carbon did not occur except in the ischemic area (×12).

blue, the walls of the vessels and the surrounding brain in the areas of hemoconcentration were stained intensely.

The continuing processes of hemoconcentration, clumping of red cells, and adherence of white cells to vessel walls resulted in progressive interference with blood flow so that segments of red cells moved more and more slowly and finally became static.

Several hours after segmentation and stasis became manifest, groups of platelets began to show temporary agglutination in masses that constantly altered in shape as the plasma eddied and flowed by them (Fig. 6). Although these agglutinated masses of platelets occasionally formed mural thrombi, they seldom remained motionless for long (Fig. 7).

Stasis of small vessels could progress within the first twenty-four to forty-eight hours and, if there was continued failure of the collateral circulation, arterioles as well as venules became static (Figs. 8 and 9). By the third day the collateral flow was sufficiently established so that no further stasis occurred. Return of collateral blood flow commonly reversed stasis present for as long as four days. Resumption of flow in static vessels began as a slow movement of clumps of red cells into bordering vessels of normal flow, where the clumps dispersed once again into individual cells. In a similar manner, platelet thrombi were moved into vessels having normal flow and there dispersed. Variations in collateral flow from day to day resulted in intermit-

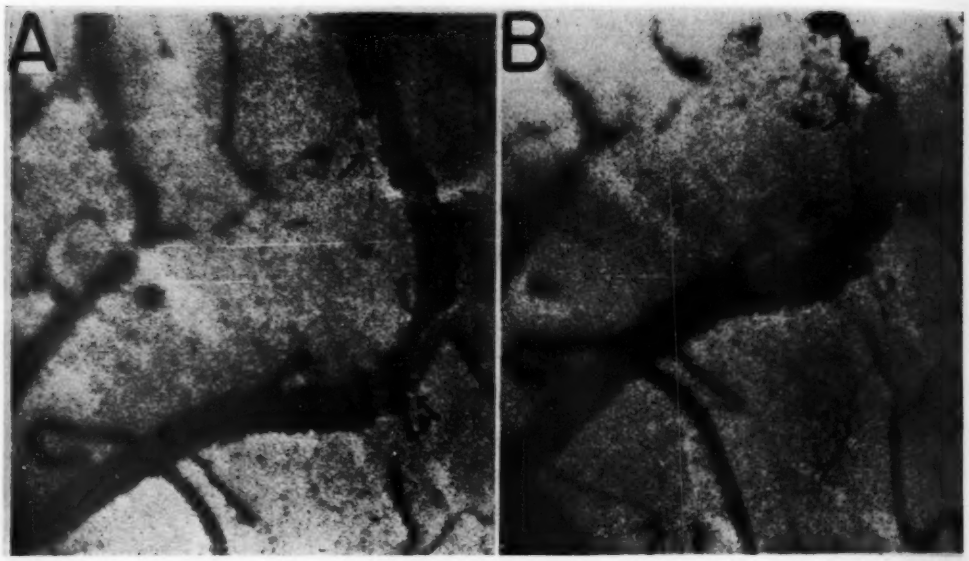

Fig. 6. Transient clumping of platelets in small pial vessles following vascular occlusion in the cat.
A. High-power view six hours after occlusion. Upper arrow points to clump of platelets, lower arrow points to white cells sticking to walls.
B. Same field three minutes later. Arrow points to same clump of platelets that has moved along the vessel and increased in size.

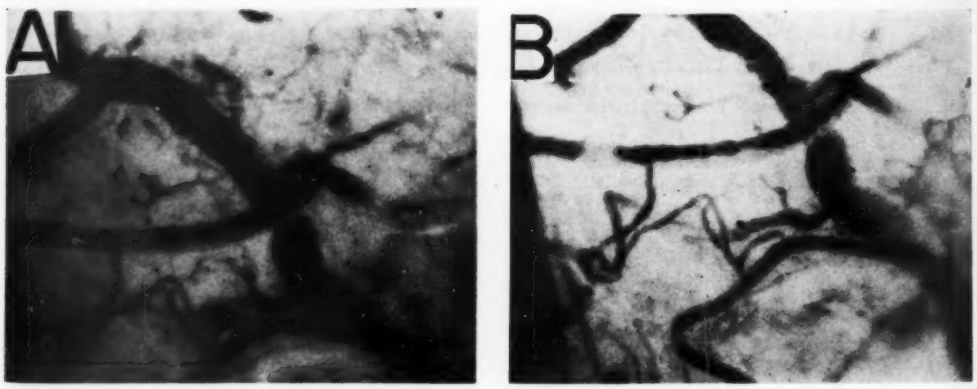

Fig. 7. Clumped red cells and platelet thrombi following vascular occlusion in the cat.
A. Six hours after occlusion of the middle cerebral artery.
B. Same field one minute after the injection of India ink. Carbon particles are beginning to agglutinate in the venules.

tent stasis and resumption of flow in small vessels. Return of flow to static vessels was accompanied by diapedesis of red cells through vessel walls and occasionally rupture of vessels, with the appearance of ball hemorrhages.

The intravenous injection of India ink after vascular occlusion resulted in a striking phenomenon limited to the ischemic zone. In these areas of sluggish flow, the submicroscopic particles of carbon adhered to vessel walls and clumped together in the terminal venules until they formed masses as large as 75 micra in diameter. Thus,

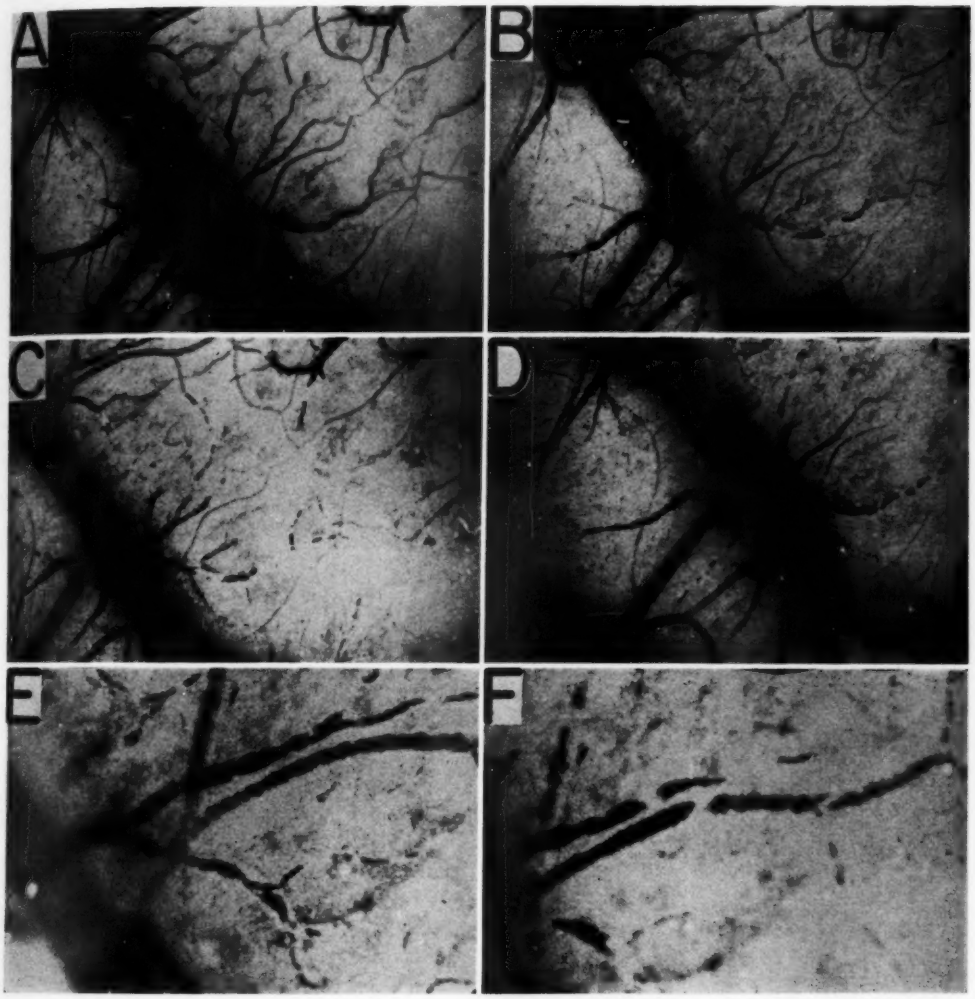

Fig. 8. Serial photomicrographs to show progressive circulatory stasis occurring within the first twenty-four hours following vascular occlusion in the monkey. A. Twenty hours after occlusion. Red cells are clumping in terminal venules.

B. Same field twenty-two hours after occlusion. Intermittent resumption of flow has resulted in flame hemorrhages around small venules.

D. Same field twenty-three hours after occlusion to show increasing hemorrhages.

E. High-power view twenty hours after occlusion to show detail of clumped red cells.

F. High-power view of same field twenty-four hours after occlusion to show slow movement of stagnant clumps of red cells.

carbon particles introduced into areas of ischemia behaved in the same manner as red cells.

The administration of heparin or Dicumarol prior to vascular occlusion modified the series of events visible in pial vessels. Flow became slowed but not to the same degree as in the untreated group of animals. Cortical oxygen tension was significantly reduced, however, and cyanosis, pallor, and collapse of small vessels occurred. Clumping of red cells and adhesiveness of white cells to vessel walls did not occur. Nor did platelets agglutinate, and platelet

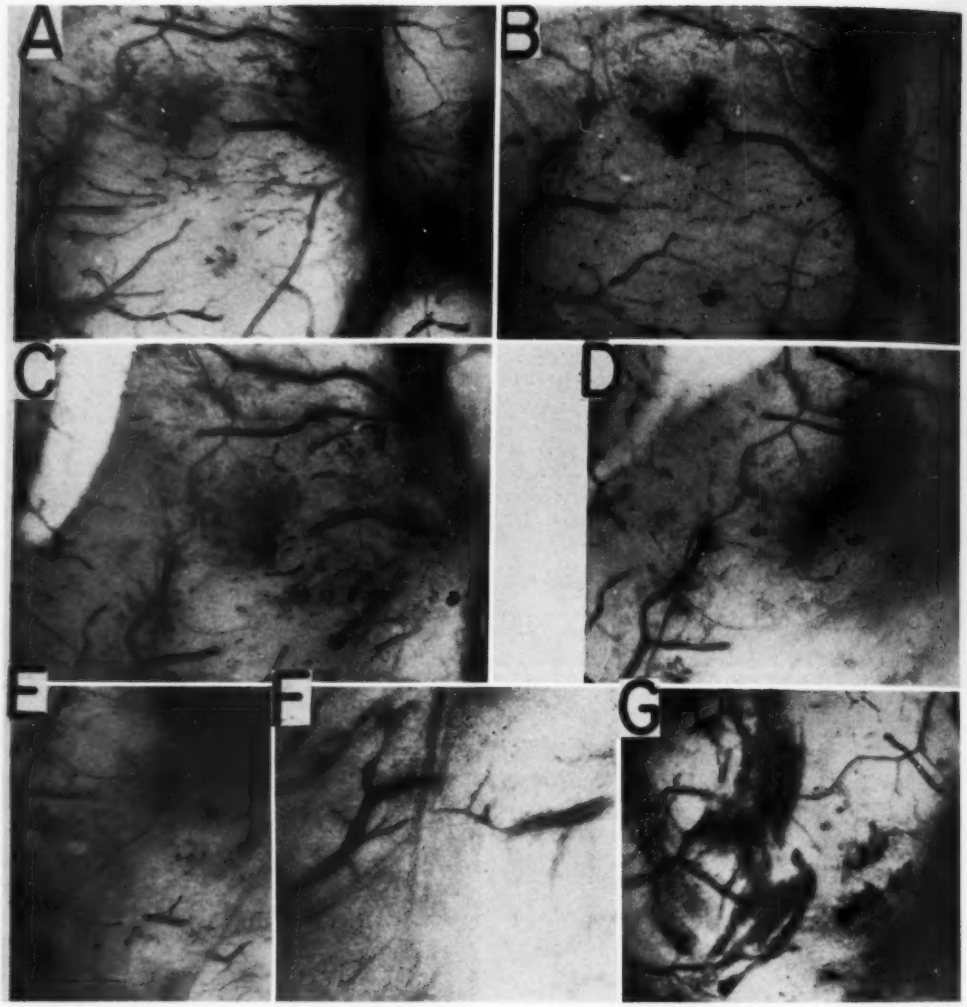

Fig. 9. Serial photomicrographs of the pial circulation in the distribution of the middle cerebral artery in the monkey to show clumping of red cells with stasis.
A. Two hours after occlusion.
B. Twenty-four hours after occlusion.
C. Forty-eight hours after occlusion.
D. Three days after occlusion flow is returned to damaged vessels, resulting in perivascular hemorrhage.
E. Four days after occlusion stasis is intermittent in some areas.
F. Detail to show persisting stasis at the fourth day.
G. Five days after occlusion return of flow results in extensive perivascular hemorrhage.

thrombi did not form. Diapedesis of red cells and perivascular hemorrhage was common (Fig. 10), but the intravenous injection of filtered India ink did not result in agglutination of carbon particles (Fig. 11 A). Increase of collateral blood flow produced more rapid resumption of normal flow in ischemic areas than in untreated animals, although resulting perivascular hemorrhage might be extensive.

SUMMARY

The mechanism of localized changes in cerebral vascular resistance following

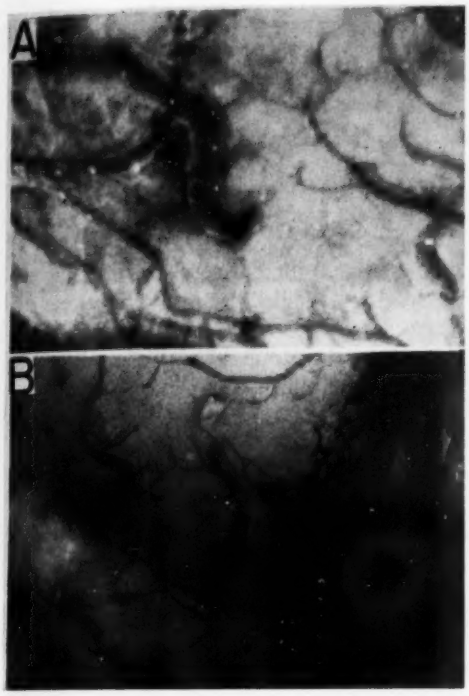

Fig. 10. A. High-power microscopic view of the pial capillary plexus in the distribution of the middle cerebral artery in an animal treated with heparin to show absence of clumping of red cells.

B. Low-power view of the same field to show perivascular hemorrhages, a consequence of improved collateral circulation.

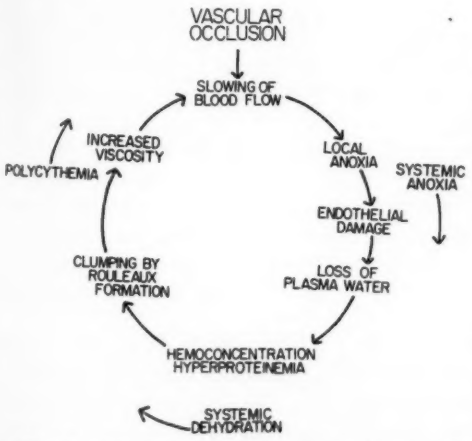

Fig. 12. Diagram to show potential vicious cycle resulting in cerebral infarction as a result of occlusive cerebral vascular disease. Anticoagulants tend to prevent clumping by rouleaux formation.

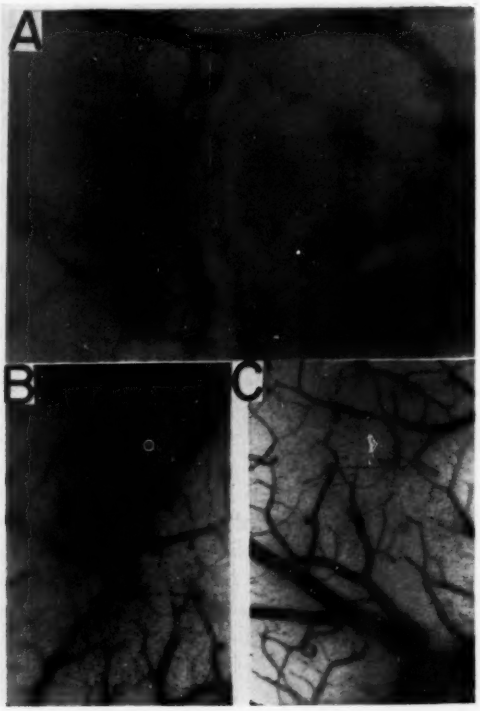

Fig. 11. Three photomicrographs to show absence of clumping of red cells and platelets in the pial vessels following vascular occlusion in the monkey treated with Dicumarol.

vascular occlusion is first slowing of local blood flow with ischemic anoxia resulting in endothelial damage and localized loss of fluid constituents of the blood. This results in brain edema and localized hemoconcentration. Hemoconcentration is followed by increased adhesiveness of all formed elements of the blood, of the endothelium, and of fine carbon particles which have been introduced into the circulation (Fig. 12).

The administration of heparin and Dicumarol prevents the adhesiveness of red cells, white cells, and platelets, and by this means prevents increased cerebral vascular resistance and promotes better collateral circulation.

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SUMMARIO IN INTERLINGUA

Theoria E Argumento Del Therapia Anticoagulante In Occlusive Morbo Cerebro-Vascular

Le arteria medio-cerebral de simias e cattos esseva occludite post retroplicar un segmento de osso. Un fenestra de Forbes esseva inserite in le segmento, e per medio de illo observationes diurne con un microscopio alti-potente esseva effectuate in le territorio ischemic. Esseva monstrate que le mechanismo del aterationes localisate que occurre in le resistentia cerebro-vascular consiste initialmente de un relentamento del local fluxo de sanguine, con anoxia ischemic e resultante in injuria endothelial e in localisate perditas de constituentes fluide del sanguine. Le consequentia es edema cerebral e hemoconcentration localisate. Le hemoconcentration es sequite per un augmento del adhesivitate de omne le formate elementos del sanguine, del endothelio, e de particulas fin de carbon que esseva previemente introducite in le circulation.

Esseva constatate que le administration del anticoagulantes heparina e Dicumarol preveni le augmento del adhesivitate de erythrocytos, leucocytos, e plachettas. Assi es prevenite le augmento del resistentia cerebro-vascular. Es meliorate le circulation collateral.

Neurosurgical Aspects of Occlusive Cerebral Vascular Disease[1]

J. E. WEBSTER, M.D., E. S. GURDJIAN, M.D., D. W. LINDNER, M.D., and W. G. HARDY, M.D.

THE SURGEON'S interest in cerebral vascular disease began in the last century with the concern for hemorrhagic collections on the surface of the brain—the epidural and subdural hematomas. In this century, with the development and use of cerebral angiography since the thirties, cerebral aneurysms and their intracranial complications have gained increasing attention. Of more than academic interest, many aneurysms are now amenable to surgical treatment.

More recently, patients having a so-called "cerebral vascular accident," or "stroke syndrome," have been referred to the neurosurgeon for evaluation. By collaboration, the radiologist also is involved in seeking a physiologic explanation for the dysfunction associated with cerebral vascular insufficiency and/or failure. Such collaboration is based mainly upon the application of the radiologic technic of angiography. This revealing premortem pathophysiologic roentgen procedure is disclosing new and important information concerning the dynamics of cerebral blood flow, information which was unavailable to the pathologist in the past. Postmortem studies of dead brains with collapsed vessels, ignoring the crucial factor of the carotid and vertebral artery inflow, have been misleading.

This brief presentation concerns the evaluation of the "stroke syndrome" from a neurosurgical point of view, based upon angiographic studies correlated with the clinical aspects of the various abnormalities in cerebral blood flow.

DIAGNOSIS

It has been of considerable interest to observe the multiplicity of causes for a stroke or "cerebrovascular accident," terms still commonly used to finalize a transfer to the morgue or a nursing home. Some rather striking observations have been made as a result of a study of "stroke" patients admitted to a cerebral vascular ward for purposes of a neurological work-up, including angiographic studies.

Among the first 200 patients studied, the following lesions were encountered.

I.	*Occlusive Disease*	
	Carotid artery (complete)	21 (3 bilateral)
	Carotid artery (partial)	20
	Anterior cerebral	15
	Basilar artery (partial)	15
	Middle cerebral trunk	9
	Basilar artery (complete)	5
	Arteriolar disease	32
II.	*Surgical Mass Lesion*	
	Brain tumor	16
	Intracerebral hematoma	5
	Subdural hematoma	3
	Brain abscess	1
III.	*Others*	
	Embolism	11
	Cerebral hemorrhage (hemorrhagic infarction)	8
	Cerebrovascular insufficiency	9
	Saccular aneurysm (1 AV)	4
	Posterior cerebral artery occlusion	2
	Cerebral atrophy	2
	Postictal state	1
	Syphilis	1
	Encephalitis	4
	Miscellaneous	16

In conjunction with complete neurological studies, all patients were evaluated by digital carotid artery compression (1). This test was first used by Caleb Parry in the 18th century, but was then confounded by the concept of the carotid sinus reflex, attributed generally to be the cause of syncope when one carotid artery was digitally compressed. Matas, however, oriented the mechanics of carotid compression to brain ischemia rather than to the induction

[1] From the Department of Neurosurgery, Wayne State University College of Medicine and Affiliated Departments, Detroit Memorial Hospital and Grace Hospital, Detroit, Mich. Presented as part of a Symposium on Occlusive Cerebrovascular Disease, at the Forty-third Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 17–22, 1957.

TABLE I: RESPONSE OF PATIENTS WITH HEMIPLEGIA TO DIGITAL CAROTID ARTERY COMPRESSION

Hemiplegia: Syncopal Responses	
Carotid artery occlusion, complete	31 cases
Syncope	26 cases
No syncope	5 cases (2 long standing)
Carotid artery occlusion, partial	21 cases
Syncope	18 cases
No syncope	3 cases (1 long standing)
Anterior cerebral artery occlusion	15 cases
Syncope	13 cases
No syncope	2 cases
Basilar artery occlusion	10 cases
Syncope	9 cases
No syncope	1 case
Hemiplegia: No Syncopal Responses	
Brain tumor, degenerative inflammatory disease, emboli, or trauma	66 cases
Syncope	11 cases (1 carotid sinus reflex; 2 papilledema; 1 chronic subdural)
No syncope	55 cases
Middle cerebral artery occlusion	16 cases
Syncope	6 cases (1 carotid sinus reflex; 1 partial carotid occlusion; 1 anterior cerebral occlusion)
No syncope	10 cases
Small artery occlusion (arteriosclerosis)	33 cases
Syncope	5 cases (3 carotid sinus reflex)
No syncope	28 cases

NOTE: Two cases of partial middle cerebral artery occlusion, 2 of bilateral carotid occlusion, and 2 partial anterior cerebral artery cases showed no syncope. In one, however, there was a bilateral carotid sinus reflex. There were 2 patients with unknown diagnoses who had syncope, due in 1 instance to a carotid sinus reflex.

of the neural reflex mechanism responsible for syncope. He used the test in a limited group of patients, preparatory to carotid ligation. In patients with evidence of cerebral vascular insufficiency or failure, associated with hemiparesis or hemiplegia, the results are valuable in suggesting the type of cerebral disease present.

Table I shows the responses of 200 patients with hemiparesis or hemiplegia to digital carotid artery compression, as correlated with the angiographic diagnosis.

The digital carotid artery compression test has now been used in hundreds of patients without serious results. We recommend that it be made a part of a routine neurological examination. It is done cautiously with the patient sitting on the side of a bed or examining table. Gentle compression is first used and the pulse noted to detect asystole from a sensitive carotid sinus reflex. If asystole is absent, firmer pressure occludes the carotid. The patient may first experience dizziness, obscuring of vision on the ipsilateral side, and faintness. The respirations increase, then deepen, and syncope usually follows. Often convulsive twitchings occur on the contralateral side, greatest in the arm. The digital pressure is released at the first sign of syncope. There is an important group of patients who have occlusive disease, particularly involving the carotids, in association with a sensitive carotid sinus reflex. In these patients, 1/100th gr. of atropine will interrupt the sinus reflex. Syncope without cardiac asystole will still occur in a number of these patients, indicating usually a carotid artery occlusion, partial or complete (Fig. 1).

An accurate diagnosis of the cause of the "stroke syndrome" seems to be essential, since management is so dependent upon the type of lesion. Mention only is necessary to emphasize the need to identify the mass lesions, including brain tumor, chronic subdural and intracerebral hematoma, abscess, and aneurysms. A common experience, continually repeated, involves the failure, even of experts, to reach an accurate diagnosis in such patients on the basis of conventional clinical neurological signs. The general practitioner is able only to make a guess as to the lesion present, often employing out-dated neurologic and psychiatric concepts of the last century.

It is now possible by means of angiography, to understand, and thus to diagnose and treat, several of the occlusive cerebral vascular diseases which are commonly encountered. Brief descriptions of these lesions follow.

Carotid Artery Occlusion (Complete): As a result of atheromatous disease involving the carotid bulb, the internal carotid may become occluded, resulting in symptoms and signs which run a neurologic gamut from dizziness to a total hemiplegia (2). The most important factors influencing the degree of dysfunction in each patient include the development of collateral circulation related in turn to (*a*) the adequacy of the blood flow and head of arterial pres-

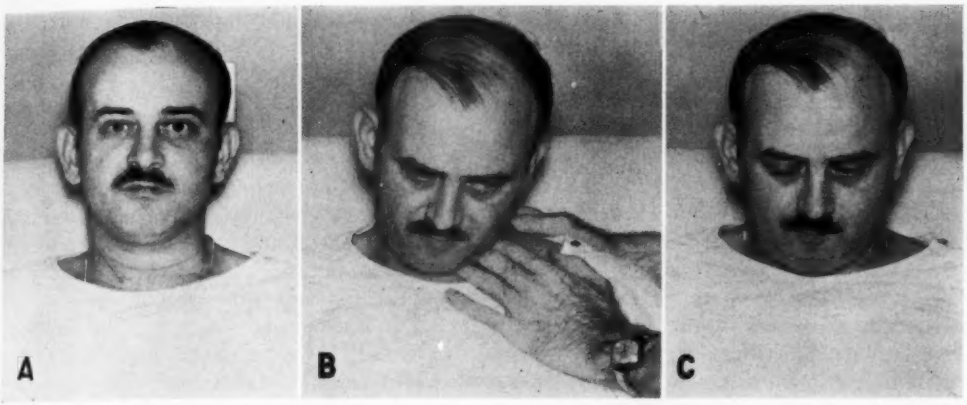

Fig. 1. Contralateral carotid compression may result in syncope with convulsive movements in patients with recent carotid occlusion (partial or complete), anterior cerebral artery occlusion, or basilar artery occlusion. A carotid sinus reflex may mask this response. A. Before compression. B. During compression; syncope begins. C. Syncope continues for five to ten seconds.

sure; (*b*) the degree of atheromatous involvement of other vessels, particularly the opposite carotid and the vertebral artery; (*c*) the ability of intrinsic brain vessels to improve flow to the ischemic brain tissue. These influences have been reviewed by Dr. John Meyer (see p. 815).

Carotid Artery Occlusion (Partial): Stenotic occlusions of the internal carotid artery may result in cerebral vascular insufficiency and failure, with profound paralytic effects. As a result of the luminal narrowing, extrinsic body influences, resulting in hypotension, or intrinsic factors reducing collateral flow within the brain, may produce brain ischemia. The degree of pathophysiologic involvement and neurologic deficit is determined by the requirement of the brain tissue for blood and the fulfillment of this demand. In the stenotic lesions bouts of insufficiency are common. These transient episodes have often been referred to as "spasms" of cerebral vessels, or "little strokes." It appears also that ulcerating plaques at the bulb may be an important source of emboli, with more distal occlusions resulting.

Anterior Cerebral Artery Occlusion: Among patients with a "stroke syndrome," occlusion of one anterior cerebral artery is often found. As shown in the listing above (p. 825), of 200 patients with hemiplegia or hemiparesis, 15 had anterior cerebral artery occlusions, usually involving the proximal portion and thus the striate arteries having their origin from that segment. It has been of interest that in these patients syncope uniformly develops upon contralateral carotid compression, emphasizing the importance of the deep or ganglionic branches which subserve consciousness directly or indirectly as they supply the anterior hypothalamic area (3). Paralysis does not occur in all of these patients, a finding again probably determined by the intrinsic collateral flow, *e.g.*, Heubner's artery, the number of striate branches, the pattern of vascularity of the internal capsule, the adequacy of flow in the middle cerebral and the carotid arteries both ipsilateral and contralateral.

An interesting pattern of psychological disturbances has been observed in these patients. Outstanding symptoms have included generalized weakness, faint-like spells, depression, confusion, dizziness, fatigue, nervousness, memory defects, anxiety, visual blurring. A number of these patients were considered as presenting "functional" or "psychosomatic" problems and were under psychiatric treatment including shock therapy.

It remains for future observations to determine the relationship of these psychiatric states, both paralytic and non-paralytic, to the blood flow *via* the anterior cerebral

arteries. These are important arteries in the lower phyla of animals, represented by the medial olfactory artery. In man, the fact that syncope occurs upon reducing the blood flow in the intact vessel when the contralateral vessel is occluded or congenitally absent seems significant.

Middle Cerebral Trunk Occlusion: Occlusive lesions of the middle cerebral trunk are commonly encountered in patients with major degrees of hemiplegia. The obstruction is usually at the junction of the middle with the anterior cerebral artery or within 1.5 cm. from the origin of the artery. Collateral circulation does not seem to be as effective as in other occlusive lesions, and the residual neurologic dysfunction is usually profound at the onset and improvement limited. In these patients, coexisting carotid bulb disease with stenotic atheromatous plaques is common. It has been of interest that syncope does not occur upon carotid compression in patients with occlusion restricted to the middle cerebral trunk.

Small Artery Disease (Arteriosclerosis, Mainly of Middle Cerebral Branches): There is a large group of patients with hemiparesis of various degrees who have what appears to be "normal" filling of the arterial channels as visualized in the angiogram. We have classified these patients in a group based upon involvement of the arterioles or terminal vessels by arteriosclerosis, in distinction to the trunk vessels occluded by atheromatous disease. In this group (arteriolar disease), hypertension and coronary and renal disease are commonly present, while in patients with atherosclerosis, normal or lower than normal pressures are more common. As in the patients with middle cerebral trunk occlusion, syncope does not occur upon contralateral carotid compression.

In the group of hemiplegics with "normal" angiograms there are a number of pathologic states which must be distinguished. This group includes the following:

(*a*) Patients with emboli.

(*b*) Patients who have had an attack of cerebral vascular insufficiency with irreversible cerebral ischemia and paralysis. Causes may be known or unknown.

(*c*) Those with basilar-vertebral artery disease. The clinical status may be that of hemiplegia without ophthalmologic signs. Carotid compression tests have been normal early but become positive as the paralysis spreads to a quadriplegia. Carotid angiograms will have been obtained early, at which time they are normal.

(*d*) Those with subsequently developing middle cerebral trunk and/or internal carotid artery thrombosis. Repeated angiographic studies may eventually reveal the type of vascular abnormality which finally develops.

Basilar Artery Occlusion: Involvement of the vertebral or basilar arteries by atheromatous disease has been identified by means of vertebral angiograms. Both complete and partial occlusions have been found to correlate with often major bilateral neurologic dysfunction. Carotid compression tests are usually positive on both the right and left sides in these patients. The complications in angiographic studies in this group have been higher than in the carotid studies.

TREATMENT

The question is frequently raised as to the value of making an angiographic diagnosis in these patients. What can be done about it? It is, of course, important, first to diagnose and treat accordingly approximately 10 per cent of patients who do not have cerebral vascular disease but a mass lesion instead.

The patients with complete carotid occlusion have been treated surgically by excision of a segment of the involved artery and a cervical sympathectomy. Any measure which increases collateral circulation through the external carotid system would seem to be worthwhile.

Patients with segmental atheromatous involvement of the carotid bulb and the internal and external carotid at their origins have been treated by an intimectomy, with removal of the plaques and stenotic areas

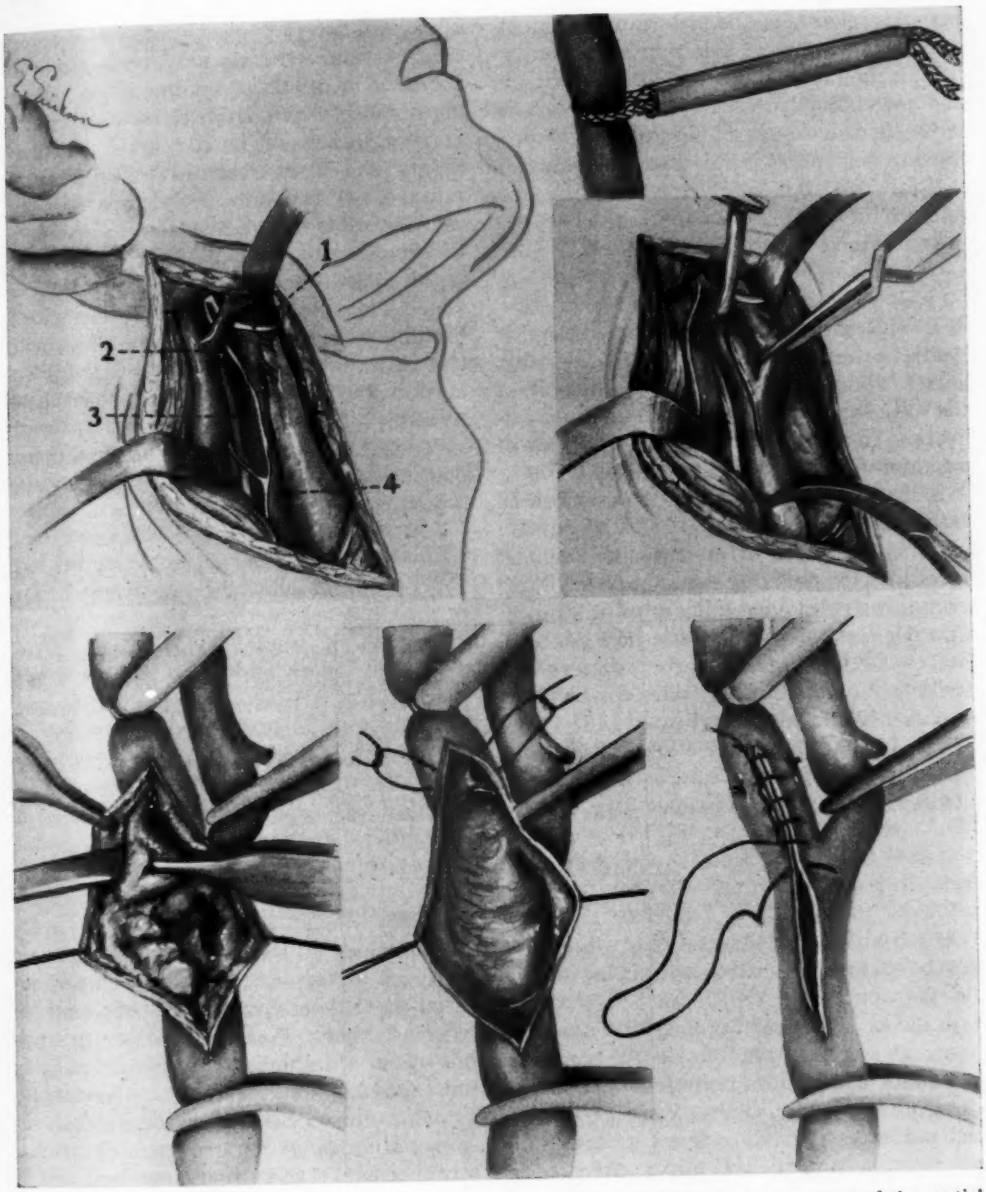

Fig. 2. A thromboendarterectomy (intimectomy) has been used successfully in the treatment of the partial carotid occlusion. Steps show the anatomical exposure of the carotid with (1) the hypoglossal nerve, (2) the carotid bulb, (3) the vagus, and (4) the internal jugular vein. The carotid vessel is incised, the atheromatous intima is excised, and the artery is closed. Reproduced by courtesy of Surgery, Gynecology and Obstetrics.

of the lumina (see Fig. 2). These patients have been previously treated by carotid compression to induce collateral flow and by anticoagulant therapy.

Anticoagulant therapy is used in the treatment of anterior cerebral, middle, and basilar occlusions before cerebral vascular failure with paralytic signs occurs. The patients are also taught to use carotid compression daily to dilate and increase

vascular channels toward improving collateral blood flow. The rehabilitation aspect is highly important. Both physical and psychological treatment is needed in reducing the degree of disability and promoting self-help, social usefulness, and a satisfaction from living. While there are, finally, unsalvable patients, these are far outnumbered by the rehabilitated.

SUMMARY

1. By means of cerebral angiographic studies, the "stroke syndrome" is being better understood. The collaboration of the radiologist with the neurosurgeon is important in making progress in this area of vascular pathophysiology.

2. A multiplicity of lesions described as "strokes" have been found in a study of 200 patients admitted to a cerebral vascular ward for purposes of a complete neurologic evaluation employing angiographic studies. Ten per cent of the patients had mass lesions. Occlusive carotid artery disease was strikingly common as a cause for cerebral vascular insufficiency and failure.

3. A valuable and safe test for cerebral vascular insufficiency in the presence of hemiparesis or hemiplegia has been the use of carotid artery compression. Upon such compression, syncope may occur, indicating a contralateral complete or partial carotid occlusion, an anterior cerebral artery occlusion, or basilar artery involvement. A sensitive carotid sinus reflex may mask these responses. Syncope does not usually occur in patients with mass lesions or occlusion of the middle cerebral artery trunk or its branches.

4. The treatment of the patient with a "stroke syndrome" is concerned first with the mass intracranial lesion. Partial occlusion of the carotid artery has been treated by thromboendarterectomy with success. Anticoagulant therapy and therapeutic carotid artery compression may also improve blood flow.

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SUMMARIO IN INTERLINGUA

Aspectos Neurochirurgic De Occlusive Morbo Cerebro-Vascular

Un multiplicitate de lesiones describite como "stroke" esseva trovate in un studio de 200 patientes qui habeva essite admittite al Division Cerebro-Vascular del hospital con le objectivo de effectuar un complete evalutation neurologic per medio de studios angiographic. Dece pro cento del patientes habeva lesiones a formation de massas. Morbo occlusive del arteria carotic esseva frappantemente commun como causa de insufficientia e disfallimento cerebro-vascular.

Un preciose e salve test pro insufficientia cerebro-vascular in le presentia de hemiparese o hemiplegia esseva le uso de compression del arteria carotic. Post le effectuation de un tal compression, syncope pote occurrer, lo que indica le presentia contralateral de occlusion carotic complete o partial, le formation de un occlusion arterial antero-cerebral, o un affection de arteria basilar. Il es possibile que un sensibile reflexo de sinus carotic resulta in le mascage de iste responsas. Usualmente syncope non occurre in patientes con lesiones a massas o con occlusion del trunco o brancas del arteria medio-cerebral.

Le tractamento del patiente con le syndrome apoplectic ("stroke") es concernite primarimente con lesiones intracranial a massas. Occlusion partial del arteria carotic ha essite tractate a bon successo per medio de thromboendarterectomia. Therapia anticoagulante e compression therapeutic del arteria carotic es etiam capace a meliorar le fluxo de sanguine.

Psychiatric Symptoms Associated with Occlusive Cerebral Vascular Disease[1]

GARFIELD TOURNEY, M.D., BERTRAM D. COHEN, Ph.D., and JACQUES S. GOTTLIEB, M.D.

THE PRINCIPAL cause of occlusive cerebral vascular disease is cerebral arteriosclerosis. A diverse pattern of symptoms occurs in this disturbance, which usually begins during the sixth decade. These symptoms include fatigue, headaches, dizziness, insidious changes in physical and mental abilities, difficulties in concentrating, episodes of confusion, excitement, gradual intellectual deterioration, changes in personality with exaggeration of premorbid personality characteristics, depression, anxiety, irritability, delusions, and hallucinations. The purpose of the present study is to attempt more definite correlation of psychiatric symptoms with a specific delineation of the central nervous system lesion. The area of involvement of the brain has been determined by careful neurological study and cerebral angiography. One goal in this approach was to see if any particular psychiatric symptoms or possibly syndromes are associated with a given area of the vascular tree of the brain. It is understood that cerebral angiography may not demonstrate any specific pathology, but localizes a disturbance within the arterial supply of the brain. A cerebral artery occlusion may occur but, because of good collateral circulation, little or no impairment may be present. Degenerative changes may also take place within the brain and not be associated with vascular alterations.

METHOD OF STUDY

Twenty-four patients suffering from occlusive vascular disease, the basis of which was predominantly cerebral arteriosclerosis, were studied. This number included 7 patients suffering from a right anterior cerebral artery occlusion, 8 with a left anterior cerebral occlusion, 1 with a left middle cerebral artery occlusion, and 2 each with right internal carotid artery occlusion, left internal carotid artery occlusion, bilateral carotid artery occlusion, and possible vertebral artery occlusion. All patients were right-handed.

After neurological and neurosurgical evaluation, including cerebral angiography, patients were referred for psychiatric and psychological study. The psychiatric study included a psychiatric history obtained from the patient and relatives, when available, a mental status examination with emphasis on the state of intellectual functioning, and various symptoms of emotional disorder. The psychological evaluation included an estimate of the intelligence level on the basis of the Wechsler Adult Intelligence Scale, utilizing the information, comprehension, and vocabulary subtests. These subtests presumably show the least deterioration with the normal aging process. Also included in the psychological evaluation were the Benton Visual Retention Test to study visual memory, the block design subtest of the Wechsler Adult Intelligence Scale to determine visual organization, and a card-sorting test to evaluate conceptual thinking. From the psychological tests, a general evaluation of the patient's cognitive functioning was made. In some cases further test material was used.

RESULTS OF THE STUDY

The results of the study are summarized in Table 1.

Psychiatric symptoms were apparent in all cases. Nine patients showed depression; 12, anxiety symptoms; 2, impulsivity; 3, delusional content; 3, hypochondriasis; 20, evidence of intellectual deficits, such as difficulty in concentrating, poor general information, memory disturbance, and, in severe cases, disorientation.

[1] From the Lafayette Clinic and Wayne State University College of Medicine, Detroit, Mich. Accepted for publication in January 1958, supplementing the Symposium on Occlusive Cerebrovascular Disease (pp. 801–830).

TABLE I: ANGIOGRAPHIC, PSYCHIATRIC, AND PSYCHOLOGICAL OBSERVATIONS IN 24 PATIENTS WITH OCCLUSIVE CEREBROVASCULAR DISEASE

Pt. and Age	Angiographic Findings	Psychiatric Symptoms	Psychological Findings
W. R., 66	Right anterior cerebral artery occlusion.	Impulsivity, argumentation, severe intellectual deficit.	Severe intellectual deficit; diffuse, left visual field defect.
A. L., 65	Right anterior cerebral artery occlusion.	Depression, mild intellectual deficit.	Mild intellectual deficit, diffuse left visual field defect; specific deficit in conceptual thinking.
A. K., 63	Right anterior cerebral artery occlusion.	Anxious, labile mood; hypochondriasis; moderate to severe intellectual deficit.	Severe intellectual deficit; diffuse left visual field defect.
E. D., 50	Right anterior cerebral artery occlusion.	Slight depression and anxiety.	Mild intellectual deficit; diffuse, specific deficit in language usage, especially in conceptual thinking content.
J. S., 34	Right anterior cerebral artery occlusion.	Severe anxiety.	Minimal intellectual deficit, diffuse, possibly attributable to anxiety.
L. L., 69	Right anterior cerebral artery occlusion.	Mild intellectual deficit.	No test.
O. Q., 58	Right anterior cerebral artery occlusion.	Depression; moderate intellectual deficit.	No test.
A. T., 69	Left anterior cerebral artery occlusion.	Severe intellectual deficit.	Visual memory mildly impaired; all other functions severely impaired.
R. N., 41	Left anterior cerebral artery occlusion.	Anxiety symptoms.	Mild intellectual deficit, specific to visuopsychic functions.
C. F., 40	Left anterior cerebral artery occlusion.	Anxiety and somatic concern.	Minimal intellectual deficit, specific to visuopsychic functions.
F. D., 54	Left anterior cerebral artery occlusion.	Mild intellectual deficit.	No test.
C. C., 69	Left anterior cerebral artery occlusion.	Severe intellectual deficit; suspicion.	No test.
I. E., 46	Left anterior cerebral artery occlusion.	Severe intellectual deficit.	No test.
D. C., 49	Left anterior cerebral artery occlusion.	Anxiety symptoms; mild intellectual deficit.	No test.
B. R., 48	Left anterior cerebral artery occlusion.	Depression; anxiety; hypochondriasis; moderate intellectual deficit.	No test.
J. P., 49	Left middle cerebral artery occlusion.	Depression; aphasia; severe intellectual deficit.	Severe intellectual deficit, diffuse in so far as testing was possible.
M. C., 55	Right internal carotid occlusion.	Anxiety symptoms; moderate intellectual decline.	No test.
L. O., 56	Right internal carotid occlusion.	Moderate intellectual deficit.	Severe specific deficits, particularly in visuopsychic functionings.
I. P., 60	Partially occluded left internal carotid artery.	Depression; anxiety; difficulty in concentrating.	Mild intellectual deficit, evident in all tests considered sensitive to deficits.
C. L., 64	Left internal carotid artery occlusion.	Depression; anxiety; moderate intellectual deficit.	No test.
J. G., 61	Bilateral carotid artery occlusion.	Anxiety; suspicion; jealousy; depression; intellectual decline.	Moderate intellectual deficit, most evident in visuopsychic functioning.
W. C., 56	Bilateral carotid artery occlusion.	Impulsive behavior; mild intellectual decline.	No test.
M. B., 44	Possible vertebral artery occlusion.	Many vague somatic delusions; anxiety; difficulty in concentrating.	Moderate diffuse deficits in individual of limited native capacity.
F. B., 56	Possible vertebral artery occlusion.	Anxiety; depression; insomnia; agitation; mild intellectual deficits.	Mild intellectual deficit.

Symptoms of depression, anxiety, impulsivity, delusions, and hypochondriasis were most apparent in those cases in which there was some disturbance in premorbid personality function. Sixteen of the patients studied showed some evidence of personality and neurotic difficulties at some time during their lives. These premorbid symptoms varied from an anancastic personality (meticulosity, compulsive work patterns, over-conscientiousness) to psychotic episodes, which occurred in 2 patients. In the psychiatric symptomatology in these cases there was a consistent exaggeration of the premorbid trends. For example, the patient with a tendency to become depressed prior to the onset of the cerebral vascular disturbance became more consistently depressed after its occurrence. The same applies to anxiety symptoms, hypochondriasis, impulsivity, and delusions.

Evidence of intellectual deficits was the most consistent finding from a psychiatric point of view. Psychological tests performed on 14 patients revealed an intelligence level of borderline deficiency in 1 case, low normal intelligence in 2 cases, average intelligence in 5, bright normal intelligence in 2, and superior intelligence in 4 cases. Degrees of deficit ranged from minimal to severe. Two patients had a minimal deficit and in 1 of these this might be attributed to anxiety. Five patients showed mild deficits; these were diffuse in 2 instances; they involved conceptual thinking primarily in 2 cases, and visuopsychic functioning (visual memory and visual organization) primarily in 1 case. There were 2 examples of moderate deficits, diffuse in 1 case and involving visuopsychic function specifically in the other. Severe deficits were observed in 5 cases; impairment was diffuse in 4 of these and in the fifth involved visuopsychic functioning specifically.

In an attempt to correlate the psychiatric and psychological findings with the angiographic studies, no specific syndrome was delineated involving any of the major arterial groups studied. No relationship was noted between the lateralization of the lesion, hemispheric dominance, and the symptomatic picture. There was a suggestion of a positive relationship between age and the severity of intellectual deficit. The gradient of deterioration with age is much more steep than in normal individuals. In 4 out of 9 cases in the age range sixty to sixty-nine years, there was severe intellectual deficit. None of the 7 patients between fifty and fifty-nine showed serious intellectual deficits. On the other hand, 2 of the 8 patients between thirty-four and forty-nine years demonstrated marked intellectual deterioration. A much larger series of cases, with careful statistical evaluation, is needed before any definite conclusions can be made regarding the age factor.

CONCLUSIONS

A study has been made correlating psychiatric and psychological findings in patients suffering from occlusive cerebral vascular disease as demonstrated by cerebral angiography. The limitations of delineation of cerebral pathology with this method have been indicated.

Psychiatric symptoms and psychological findings shown in these cases included anxiety, depression, hypochondriasis, impulsivity, and delusional content, as well as many signs of intellectual deficits and deterioration.

No positive relationship was noted between the lateralization of the lesion, artery involvement, and hemispheric dominance in these patients. Hence, no specific psychiatric syndrome related to involvement in any of these areas could be defined.

There was a suggestive positive relationship between age and the degree of intellectual deficit. The older the patient the more likely he is to have severe deficits. This gradient of deficiency is sharper than the normal gradient anticipated with the aging process. However, more patients would have to be studied before any conclusions can be reached in this respect.

There appeared to be a positive relationship between evidence of a premorbid per-

sonality disturbance and the development of psychiatric symptoms such as depression, anxiety, impulsivity, hypochondriasis, and delusional content. As has been noted in previous studies of organic brain disease, it is characteristic that premorbid personality trends are exaggerated with the organic disturbance, regardless of its cause.

Four pertinent questions may be asked in regard to this observation. First, are the neurotic and personality difficulties manifestations of a subclinical impairment of the cerebral circulation? Second, does the occurrence of the demonstrated cerebral arterial insufficiency release latent neurotic and aberrant personality trends? Third, do the psychiatric symptoms occur as an emotional and symbolic reaction to the deficits in intellectual functioning? Finally, does the occurrence of chronic neurotic and personality difficulties with their accompanying changes in vegetative neural activity (functional changes in heart rate and blood pressure) actually lead to secondary organic changes within the vascular system? The present study is limited in its approach to these all-important questions, but it is the impression of the authors that questions two and three can often be answered in the affirmative. The first and last questions pose interesting areas for further research.

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SUMMARIO IN INTERLINGUA

Symptomas Psychiatric, Associate Con Occlusive Morbo Cerebro-Vascular

Ha essite effectuate un studio correlative del constatationes psychiatric e psychologic in patientes con occlusive morbo cerebro-vascular demonstrate per angiographia cerebral. Es signalate le limitationes del delineation cerebro-pathologic effectuabile per iste methodo.

Le symptomas psychiatric e le constatationes psychologic in iste casos includeva anxietate, depression, hypochondriasis, impulsivitate, e contento delusional, como etiam multe signos de deficits e de deterioration intellectual.

In iste patientes nulle relation esseva notate inter le lateralisation del lesion, le affection arterial, e le dominantia hemispheric. Per consequente il non esseva possibile definir ulle specific syndrome psychiatric relationate a affectiones in le un o le altere del regiones mentionate.

Il existeva un relation positive, de valor suggestive, inter le etate del patientes e lor grado de deficit intellectual. Quanto plus vetule le patiente, tanto plus probabile que ille ha sever deficits intellectual. Le ascendentia de iste deficits es plus acute que le ascendentia normal que se expecta con le avantiamento del etate. Tamen, plus grande numeros de patientes debe esser studiate ante que conclusiones definite pote esser derivate in iste respecto.

Il pareva exister un relation positive inter le presentia premorbide de disturbationes characterologic e le disveloppamento de symptomas psychiatric. Como previe studios de organic morbo cerebral ha signalate, il es characteristic que premorbide tendentias characterologic es exaggerate con le declaration del disturbation organic, sin reguardo a su causa.

Physical Medicine and Rehabilitation for Hemiplegic Patients[1]

MAX K. NEWMAN, M.D., BARBARA JEWETT, M.S., and GERALD FRAMPTON, B.S.

EXTENSIVE WARTIME and recent civilian experience, coupled with modern medical and surgical advances, has improved the forlorn outlook of the brain-damaged patient. In a recent study (1) of chronic illnesses as seen in a county nursing home, it was found that over 50 per cent of the cases were attributable to disorders of the nervous system, the majority of which were caused by thrombi secondary to atherosclerosis. When all the major disabilities due to atherosclerosis, including thrombotic cerebrovascular accidents, cardiac failure, and amputations, were included, they added up to 30 per cent of 431 patients. One must conclude that, as a cause of disability, the cerebral vascular accident is far more prevalent than coronary sclerosis, despite the high rank of the latter as a cause of death in this country.

Because of improved neurosurgical technics, together with current advances in control of vascular (anticoagulants) and infectious (antibiotics) complications, most hemiplegics will survive the acute episode. With modern methods of physical medicine and rehabilitation, over 90 per cent of all patients can be made self-sufficient, learning to ambulate and care for their personal needs. This result obviates prolonged residence in the hospital, chronic illness center, or nursing home and restores the patient to the family group.

In cooperation with the Section of Neurosurgery, a total program of physical medicine and rehabilitation, both diagnostic and therapeutic, has been developed in the Brain Damage Ward at Detroit Memorial Hospital. In this team approach, the physiatrist coordinates all rehabilitation activities with the neurosurgeon, internist, urologist, and orthopedist. The patients are "segregated" in a single wing in the hospital, so oriented that nursing care, physical therapy, and occupational therapy are carried out as a functioning totality. In the acute stage, management is directed to saving the patient's life, determining and correcting the etiologic mechanisms, providing skilled nursing care, and preventing physical and mental complications. The duration of this phase varies from as little as twenty-four hours (in some embolic, thrombotic, and vasospastic states) to several weeks (in hemorrhagic cases). The detailed cooperation of the team is most important, since medical and surgical problems require concomitant correction and prolonged supervision, for the physical restoration is only as sound as the medical foundation upon which it is based.

Nursing care is directed toward maintenance of proper posture and alignment in bed, for vital functions and comfort. Care must be exercised to avoid limb contractures, as the flaccid becomes a spastic member. Pillows, sandbags, footboards, and metal or plaster-of-Paris splints are effective in maintaining joints in neutral positions and in preventing painful capsular and muscular contractures (in the lower extremity, the externally rotated hip, knee flexion, and foot drop; in the upper extremity, the adducted shoulder, flexed elbow and wrist, and closed hand). Special nursing procedures directed to care of the skin, bowels, and bladder, nutrition, and sleep are important (2).

During the acute stage, the physiatric program is instituted in full force, beginning with early morning instruction in self care (*i.e.*, feeding, dressing, sitting up in bed or chair, rolling in bed, etc.) with general conditioning in the later morning—the ward program. Mild heat,

[1] From the Department of Physical Medicine and Rehabilitation, Detroit Memorial Hospital, Detroit, Mich. Accepted for publication in January 1958, supplementing the Symposium on Occlusive Cerebrovascular Disease (pp. 801–830).

stroking massage, electrical stimulation for passive exercise, and manual passive movements decrease pain and swelling of the extremities, prevent onset of contractures, maintain an awareness of residual proprioceptive and motor functions, and ameliorate spasticity. Simple types of muscle exercise are instituted while the patient is confined to bed, so that self-assisted motion is achieved in the involved limbs with the aid of the sound limbs. Wall-attached pulleys are also of use in this connection. Should flaccidity be present, discretion in the use of strenuous motion (passive) is necessary to prevent joint trauma, dislocation, or fracture. A rapid development of the program follows, with sitting up in bed, dangling of the lower extremities so that they touch footstool or floor (for proprioception), standing, assisted ambulation, and balancing.

Progressive spasticity requires reassurance of both the patient and his family. Emphasis must be placed on his increasing abilities and improvements rather than on the residual impairment (at this stage the usual practice has been to "wheelchairize" the patient and dismiss him to the home, county infirmary, or nursing home).

Functional rehabilitation employs the residual functions rather than the deficits for production of motion, as illustrated in the following case :

CASE I. A patient with right cerebral thrombosis, eight days after incident, exhibited total inability to move the left arm and slight elevation of the left knee in supine position. When this patient was placed upright in parallel bars and assisted, he was able to move the lower extremity in a reciprocal pattern characteristic of normal ambulation. When the head was rotated to right and the right fist was clenched, the left arm showed motion at the left shoulder and slid along the parallel bar. This is actually an example of the reinforcement technics frequently employed in rehabilitation (4).

In the subacute stage, the definitive program is intensified and training is outlined. As the subacute merges into the chronic stage, a coordination of the programs of physical and occupational therapy, speech and psychological evaluation, early prevocational training, and vocational testing ensue. This may be described under three heads: evaluation, prognosis, and goals.

Evaluation: Detailed evaluation includes consideration of the neurologic, psychiatric, medical, social, and vocational aspects of the case.

Neurological considerations depend on the integrative and associative organization of the brain, basically influenced by the sensory input and the motor output. The site of the lesion is often of prognostic value. Angiographic survey may lead to a more accurate localization of involvement of the various branches of the cerebral arteries, associating symptoms and signs in an anatomic pattern (3). The triad of prolonged flaccidity, hemianesthesia, and hemianopsia is unfavorable.

Combinations of motor, sensory, aphasic, and proprioceptive disturbances often call for a rational rather than a routine program of treatment. The type of aphasia must be determined so as to permit methods applicable in establishing contact with the patient (verbal, written, or demonstration methods) (6).

The type of dyskinesia must be noted in reference to the neuromuscular status. Spasticity, rigidity, flaccidity, tremor, and athetosis may require various combinations of restorative procedures, such as adaptive devices, bracing, and surgery (chemopallidectomy). Pharmacologic agents must be selected (sedative, relaxant, anticonvulsant, antispasmolytic). A whole new field of therapeutic "shortcuts" has been developed in the utilization of afferent patterns; this is connected with partial or total interruption of afferent pathways (5). Uncontrolled proprioceptive stimulation, indiscriminate re-education of agonist and antagonist may increase spasticity and interfere with rehabilitation.

CASE II: A patient with severe left spastic hemiplegia undergoing muscle re-education showed constantly increasing degrees of spasticity in the left hand, until the fingers and wrist curled in severe

flexion. Blocking of the nerve to the hyperactive muscles was followed by surgical deafferentation, resulting in a simple increment in voluntary function of the finger and wrist flexors. Nerve section permitted about three months of intensive muscle re-education of the extensors, with a good functioning hand as the final result.

Psychiatric and psychometric investigation is indicated in patients who appear to be poorly motivated, depressed, or mentally retarded in their personal and social adjustments. A latent tendency or a subclinical state might become an overt psychosis or a severe neurosis when associated with a "stroke." Frequently, the psychometric study is employed in order to afford a subjective and objective evaluation of intelligence, perception, judgment, aptitude, skills, and emotional stability. The tests may indicate loss of spatial or temporal perception, impaired learning ability, faulty judgment, and other cortical disturbances. Thus patients may not be able to learn crutch gaits because of inability to execute repetitive motions in various planes and retain memories of these patterns of motion (7). Organic (thalamic) emotionality is to be differentiated from psychogenic lability. The former is characterized by spontaneous outbursts of laughing, crying, and severe and bizarre pain without apparent reason or causation.

The social evaluation should uncover the personal and family attitudes and resources for rehabilitation, the home situation (both physical and emotional), and inherent future problems. At this point, the attending physician can be most useful in orienting the patient and his family as to the condition present, the future period of training, the role of the paramedical personnel, and the prognosis. The integration of the patient and his problems with the family (and its problems) rests with the physician. Where necessary, the aid of the visiting nurse, physical and occupational therapist, and medical social worker may help in apparently insoluble family problems. Many times, treatment in group situations, as employed in the department of physical medicine and rehabilitation, affords the stimulation and motivation for social adjustment, limiting introspection, and raising morale.

Early testing by vocational rehabilitation counselors is an essential. In the institution from which the present report comes, this is done in association with the Office of Vocational Rehabilitation, Detroit League for the Handicapped. Interviews and testing of aptitudes, interests, and skills aid in suitable training and early employment placement (such as home, sheltered workshop or competitive surroundings).

It is noticeable that the neurologic examination does not usually correspond with the improvement of function as determined by physiatric evaluation. The total evaluation, therefore, should be by means of proper neurologic and functional capacities examinations. It is necessary to tabulate the findings relevant to physical retraining in order to allow an objective and periodic review of progress. The pertinent data include: (*a*) manual muscle test of strength, coordination, and spasticity at all joints; (*b*) extent of flaccidity; (*c*) severity of dysarthria and aphasia; (*d*) impairment of special senses; (*e*) state of motivation; (*f*) associated disease (convulsive seizures, nephritis, cardiac disease, encephalomalacia, etc.); (*g*) local joint phenomena (contractures; severe spasticity). The principle of ontogeny as a recapitulation of phylogeny applies to the recovery of muscle groups, *i.e.*, the more primitive or gross motions are restored before the finer, more recently acquired movements (wrists, fingers, dorsiflexion of the feet, hip and shoulder abduction). This principle is equally applicable to the strong flexors in the upper extremities and extensors in the lower extremities. It points to the importance of not overdeveloping antagonists as agonists in functional re-education of paralyzed muscles.

Prognosis is improved by the availability of adequately trained personnel—*i.e.*, nurses, physical and occupational therapists, speech therapists—all working

as a harmonious team toward the ultimate recovery of the patient. Selection of such personnel is based upon ability to understand the patient, to aid in overcoming his discouragement, maintain attention, stimulate interest, and challenge his pride toward the conquest of his disabilities.

Goals: On the basis of the above findings, one may establish the treatment plan and probable goals, which may be progressively outlined:

Partial self care, for the severely handicapped or diseased, the mentally deteriorated, or apathetic involves primarily training in the personal activities of daily living. It stresses hand and trunk functions and the use of a wheel chair without assistance. The patients are instructed in safe, efficient methods in order to achieve the maximum in personal independence, such as turning in bed, sitting upright from a supine position, dressing, personal hygiene, toilet hygiene, eating, communication (left-handed writing or typing), application of necessary splints or braces, self-administration of hypodermic injections. Special devices, modification of clothing (use of zippers) and shoes to permit dressing with one hand, collapsible lightweight wheel chairs with brakes, self-propelled with the intact hand, are a few of the means used for training. The maintenance of personal dignity and freedom of the patient's family are adequate reward for the time spent in developing the skills of self-care.

Training the patient in ambulation involves a continuation of the early measures, namely:

1. Balance training: first, sitting in bed; then on a chair; then standing between parallel bars; then balancing with a crutch or a cane; finally independent stance with good posture.

2. Alleviation of joint pain and contractures of the shoulders, hands, and feet by means of heat (moist packs, infrared rays, hydrotherapy, diathermy, ultrasound, paraffin), passive exercise, massage, active exercise with pulley and rope arrangements whereby the intact limb moves the paretic or spastic one, use of the Powder board and graded occupational therapy.

3. Release of spasticity with heat, pulley exercises, prolonged sinusoidal or faradic stimulation, and active exercise including gait training. Resistive exercises are of value in restoring muscle strength and in many instances reduce spasticity. Muscle relaxant drugs have a limited value but may be used in conjunction with physical measures.

4. Muscle re-education for the re-establishment of reciprocal innervation of the agonist-antagonist groups. A variety of pathologic reflex mechanisms are used in muscle re-education, such as the tonic neck reflex, synkinetic or abnormal associated movement patterns (*e.g.*, climbing reflex of Strümpell, eliciting foot dorsiflexion during resisted hip flexion), bimanual and bipedal activities in physical and occupational therapy to encourage crossed learning phenomena and reciprocal innervation, proper splinting (*e.g.*, abducting the spastic thumb and thus facilitating finger extension), primitive crawling patterns, relaxation exercises, coordination exercises in physical and occupational therapy with the body in a functional position (*i.e.*, prone, sitting, or standing). Efforts are directed toward the excitation of spontaneous movements, utilizing the primitive postural, vestibular, or midbrain reflex arcs upon which functional movements are superimposed. This is achieved by means of conditioned reflex training and repetitive exercise, muscle (movement) re-education, occupational therapy, and gait training.

5. Occupational therapy activities with the bicycle, jig saw, loom, treadle devices, woodworking, remedial games, clay modeling, etc., as specifically prescribed, are planned to increase range of motion, strength, and co-ordination of affected limbs.

6. Gait training is done in parallel bars, with the use of a mirror, to establish a heel-toe gait, to diminish clonus, and restore a normal pattern of reciprocal

motion beginning with four-point alternate gait and progressing to a gait with the assistance of one cane. The primary aim should be the prevention of faulty habit patterns (hip circumduction and external rotation), with intensive practice in a graceful, nontiring means of locomotion. Many patients can practice this method at home with minimum supervision. Braces are frequently used: (*a*) short leg double-bar upright brace with Klenzak ankle joint, with a T-strap to control inversion or eversion; (*b*) long leg brace with knee locks where the quadriceps is weak.

Upper extremity function can be aided by a light weight forearm cockup splint with wrist in slight hyperextension and the thumb abducted. Complete return of function of the hand is unusual, and afferent proprioception may be obtained by nerve block or nerve section to the hyperactive muscles.

7. Training in climbing stairs, ramps, street curbs, entering an automobile, and overcoming obstacles in traveling complete the gait activities.

8. General conditioning to attain stamina and endurance.

Self-sufficiency implies a recovery of all major functions, including speech. In this instance, speech therapy should be given concurrently with physical and occupational therapy, since one enhances the other.

Vocational aptitudes are frequently discovered by psychometric tests and activity in occupational therapy. Further training and job placement are often feasible. More widespread acceptance of hemiplegic and otherwise handicapped persons by society and industry will eventually justify the measures necessary for their rehabilitation.

SUMMARY

The hemiplegic patient is capable of unrealized restoration from a physical, mental, and social level. When an integrated plan of treatment involving medical, neurosurgical, physical, psychological, and vocational aspects is applied, at least 90 per cent of hemiplegic brain-damaged patients are amenable to rehabilitation in its various goals.

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SUMMARIO IN INTERLINGUA

Medicina Physic E Rehabilitation De Patientes Hemiplegic

Le patiente hemiplegic es capace de nonrealisate grados de restauration ab le puncto de vista physic, mental, e social. Quando un ben-coordinate plano de tractamento es utilisate—considerante simultaneemente le aspectos medical, neurochirurgic, physic, psychologic, e professional—al minus 90 pro cento del patientes hemiplegic con lesiones cerebral pote beneficiar de effortios rehabilitatori.

The Bone Changes of Madura Foot[1]

Observations on Uganda Africans

A. G. M. DAVIES, M.D., D.M.R.D.

MYCETOMA PEDIS or Madura foot is the name used to indicate a clinical entity resulting from invasion of the foot, and occasionally other parts of the body, by a filamentous fungus. It is thought that the fungus is usually introduced by the prick of an infected thorn or splinter. It is characteristic of the disease that bodies of various shapes, resembling small grains which are, in fact, clumps of fungi, should be found either in the discharge from the affected area or in a biopsy specimen (Abbott, 1956).

Although mycetoma pedis has a wide distribution throughout the tropics and subtropics, comparatively few descriptions of its radiological features have appeared in the English literature (Pagenstecher, 1922; Grantham-Hill, 1931; Jones and Alden, 1931; Carroll, 1949). The present paper will describe the main radiological findings in 21 cases among Uganda Africans admitted to Mulago Hospital, Kampala, during the last five years.

CLINICAL AND PATHOLOGICAL PICTURES

As would be expected, the disease is almost wholly confined to barefooted cultivators. It is commoner among men (16 men to 5 women in this series), but while this may reflect the lessened exposure risk of women in some countries, in Uganda, where much of the cultivation is done by women, it is in keeping with the relative hospital admission rate of the two sexes. It is probably a coincidence that among the Mulago patients the right foot should be twice as commonly involved as the left. No age is immune, but the disease is usually found among those in the active years of life; in the present series, the average estimated age was forty-six, and the youngest patient was twenty-eight years old.

The duration of the disease before the patient seeks medical aid varies enormously, for while some will come to the hospital within a few months of the onset of symptoms, the majority do not report for two or three years. One patient in the present series waited for eight years, and another for five years. This wide variation is probably related to the degree of pain suffered, for although a few complain of "pins and needles" or a throbbing sensation of varying severity, the majority experience little discomfort. Only 3 of the Mulago patients complained of severe pain.

Fig. 1. Clinical appearance of Madura foot. The patient was admitted with a history of swelling of the foot for about a year and of multiple discharging sinuses for six months.

The clinical course of the disease has been described in detail by Abbott (1956), who collected reports of 1,231 cases from Sudan hospitals during a period of two and a half years. He classifies his cases, according to the color of the fungus grains, into yellow, black, and red mycetoma. He states that there is first a painless swelling of the affected part, and that, while in yellow mycetoma this swelling has ill-defined margins and involves only the skin and subcutaneous tissues, in black mycetoma it takes the form of a clearly defined,

[1] From Mulago Hospital, Kampala, Uganda, Africa. Accepted for publication in December 1957.

hardish, painless nodule in the subcutaneous tissues. Sooner or later, as the disease progresses, nodules which are paler than the surrounding dark skin form on the surface; later, these form vesicles which open to reveal the mouths of sinuses. From these a purulent mucoid fluid is discharged, in which the characteristic "grains" of the size from a grain of rice to a bantam's egg, the grains of yellow and red mycetoma are embedded individually in the sinuses and bones. A noticeable feature is that nerves and tendons are highly resistant to invasion, and neurological symptoms and trophic changes are conspicuous by their absence.

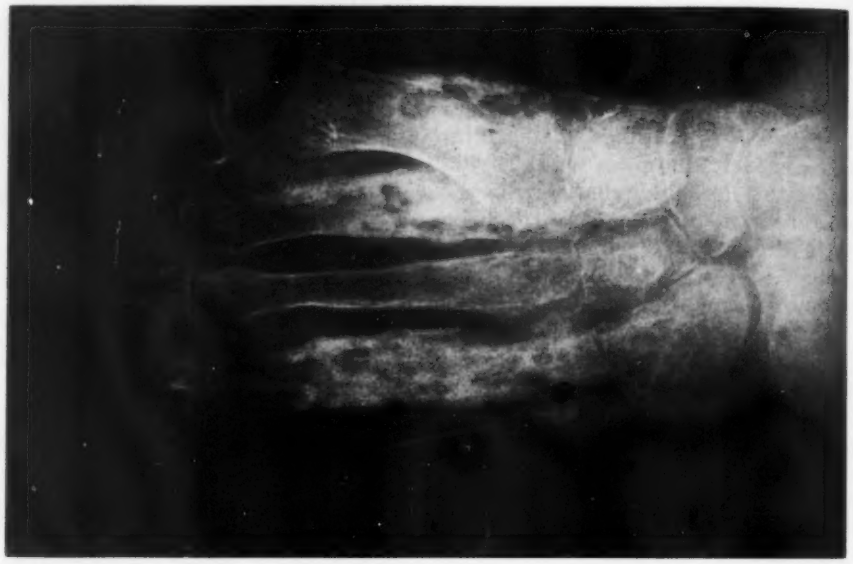

Fig. 2. Madura foot of two years duration. Multiple sinuses, mainly in the metatarsals, with cortical erosions chiefly in the lateral cuneiform bone.

fungus are seen. As the tumor develops, more and more discharging sinuses form, while earlier ones close to leave pale scars. This process continues until the surface of the tumor mass is studded with fresh nodules, discharging sinuses, and scars.

While the tumor is swelling outward, invasion of the deeper tissues is taking place. At first black mycetoma remains localized, but later it spreads along tissue planes under the skin until finally, after a period of years, it surrounds and begins to destroy muscle and bone. Yellow and red mycetoma, on the other hand, infiltrate the underlying muscle and bone from the first and do not tend to spread along tissue planes. Another difference between the types is that, while the grains of black mycetoma tend to aggregate into clumps, varying in

MADURA FOOT IN UGANDA AFRICANS

Although the clinical appearance of mycetoma pedis in Uganda Africans is similar to Abbott's description from the Sudan, the discharge from the sinuses in Mulago patients is usually a blood-stained serous fluid, in which fungus grains are rarely found. It is only on histologic section that these grains are seen and, even then, they are so scanty that classification by color alone is out of the question. Nor has culture been possible. Indeed, in 4 of the cases under discussion the histology showed merely chronic inflammatory change consistent with Madura foot. These cases are included in the present series only because they were both clinically and radiologically typical of others in which the diagnosis was confirmed

by the discovery of fungi. This fact is of some significance for, while the clinical picture is usually diagnostic, this is not always the case, and other forms of chronic sepsis of the feet, with or without sinuses, are common among barefooted peoples. Again, Kaposi's sarcoma, in which the soft-tissue nodules are often infected, can resemble mycetoma clinically and this disease is by no means rare in Uganda Africans (Davies, 1956). In these circumstances, any additional aid to the diagnosis of Madura foot, such as radiology, is to be welcomed.

The Radiological Picture: In the majority of cases in the present series (18 out of 21), the radiological signs were sufficiently characteristic either to permit confirmation of a clinical diagnosis or to give a strong pointer to the correct diagnosis when the clinical picture was atypical. In these cases, some swelling of the deep soft tissues of the foot was a constant feature and, in some, surface nodules could also be seen (Fig. 2).

The site of the original bone involvement, or at least the area most heavily affected, was usually in the second row of tarsals and in the bases of the adjoining metatarsals. In only 4 patients was it in the heads or shafts of the metatarsals or phalanges.

In the bones, both destructive and productive changes were invariably present.

Fig. 3. Case with a history of about two years. Right foot showing soft-tissue swelling, cortical erosions, and amorphous sclerosis. The correct diagnosis was suggested on the radiological appearances, but at that time the clinical findings were equivocal. The patient refused treatment but was readmitted fourteen months later with clinically typical Madura foot, which was proved histologically.

The earliest of such changes seen was a loss of definition in the cortical margin (usually an articular margin) of the affected bones (Fig. 3), followed later by an erosion of the cortex (usually ragged but occasionally smooth) from without and the formation of crypts representing the mouths of sinuses (Figs. 2 and 4). There is almost always a periosteal reaction and this is characteristically ragged. It usually takes the form of spicules of bone up to a centimeter in length projecting perpendicular to the line of the cortex. The spicules may be so close together that they resemble a ragged palisade (Fig. 4); in other cases they suggest the uneven bristles of a partly worn brush (Fig. 5). The linear or "onion peel" type of periosteal reaction is rare. The

spongiosa of the affected bones is almost invariably denser than normal, showing an amorphous sclerosis with loss of the normal trabecular pattern. Within the sclerosed spongiosa, and sometimes extending through to the cortex, multiple sinuses are often seen as small round or irregular translucent areas from 3 to 10 mm. across. In characteristic features of the disease were absent. In 1 patient, a woman about forty-five years of age with a history of five months duration, the only radiological change was swelling of the plantar fascia under the tarsals. Within the swollen fascia a number of small areas of translucency could be seen, which were pre-

Fig. 4. Madura foot of between two and three years duration, with a palisade type of periosteal reaction, multiple sinuses, and cortical erosions. Fungus grains were present in the discharge. A wisp of bone lies between the heads of the first two metatarsals.

places these sinuses have joined up and the bone seems to be disintegrating. The bones distal to those primarily involved are commonly osteoporotic. In an affected tarsal bone, the dense spongiosa with its translucent areas and the irregular eating away around its periphery suggests the appearance of a blob of melting snow (Fig. 6). As the disease progresses and the bones shrink in size, the gaps between them increase; this is a very typical feature in advanced cases.

Although sequestra of the type usually associated with inflammatory disease of bone are not seen, there are occasionally wisps of bone in the soft tissues (Figs. 4 and 5), as if a thin shell had separated from the outer layer of the periosteal new bone.

Three cases in the present series did not conform to the typical pattern which has just been described, in that the most sumably sinuses. In 2 other cases, with histories of between two and three years, deep soft-tissue swelling and amorphous sclerosis in the spongiosa were present and, while the cortex showed early signs of destruction in places, there was no penetration into the spongiosa, nor were there any sinuses within the sclerosed bone. Periosteal reaction was absent. In all these cases fungus grains were found histologically, but in none of them was the correct radiological diagnosis made.

On the evidence available, it appears that these 3 cases were probably examples of early invasion by the fungus and that later they would have produced the typical picture. If this assumption is correct, then three stages of Madura foot can be recognized radiologically in Uganda: first, the stage of early invasion, with the formation of swellings and sinuses in the soft

Fig. 5. Madura foot of about two years duration: brushwork periosteal reaction along the shaft of the first metatarsal. A wisp of bone lies between the heads of the first and second metatarsals. This case was clinically typical but no "grains" were found in the discharge. Biopsy refused.

Fig. 6. The "melting snow" appearance of advanced Madura foot; duration five years. Fungus grains are present.

tissues; then the attack on the cortex from the outside; finally a break-through, with rapid spread of the disease throughout the whole bone, producing the characteristic picture in the majority of cases.

Although the three radiological pictures described above were the only ones seen in the Uganda series, two other rare types have been reported by Grantham-Hill (1931). One of these consisted of an interosseous tumor occurring in the shaft of a long bone, usually the tibia. The tumor is seen as a large cystic swelling arising in the spongiosa and often expanding the bone locally. Beyond the margins of the cyst, which are fairly well defined, there is a

surrounding sclerosis. At operation, the cyst is found to contain a large clump of black fungus grains. Abbott (1956), who reported 4 similar cases, suggests that the cause is a blood-borne infection. In another type there is a localized swelling of the periosteum which may resemble a syphilitic periostitis. The swelling so formed has a compact structure without sinus tracts and at operation it is found to be encapsulated and to strip easily from the underlying bone, which has escaped invasion.

Differential Diagnosis: The appearance of the commonest form of Madura foot seen in Uganda must be distinguished from septic osteomyelitis, tuberculosis, syphilis, malignant tumors, and coccidioidomycosis. As the writer has had no personal experience with the last named disease, it will not be discussed in the differential diagnosis. In septic osteomyelitis, productive and destructive bone changes are found, but sequestra and involucrum production are common; the periosteal reaction is usually linear, and sinuses, when they occur, are less numerous. In osseous tuberculosis the changes are primarily destructive; osteoporosis is the rule and periosteal reaction is slight or absent. The presence of sinuses and the irregular erosion around the whole periphery of the bone with the resultant widening of the joint spaces would serve to rule out syphilis even if the clinical pictures were not so entirely different. Kaposi's sarcoma can resemble Madura foot clinically, but in the former there is no periosteal reaction, the erosion is more regular, and there are no productive changes. Secondary tumors do not usually involve the extremities nor do they destroy the cortex from without. Again, the clinical picture is quite different.

DISCUSSION

From the above it would appear that the radiological changes in Madura foot can take several quite distinct forms and, in the rarer manifestations, accurate diagnosis by radiology alone is unlikely. Even in the commonest features some variation is found among the cases which have been described in the literature. In one of the cases illustrated by Abbott (1956), the areas of erosion appear to be much more compact and to have much better defined margins than is usual in Uganda; his other x-ray illustration, however, shows the typical picture described above. Pagenstecher's 2 cases (1922) and the case recorded by Jones and Alden (1931), all show mainly productive changes and comparatively few, if any, sinuses. Carroll (1949), on the other hand, has emphasized the decalcification and absence of surrounding bone reaction and sclerosis in the case which he has described. When, however, it is considered that Madura foot is only a clinical entity which can be caused by a number of different filamentous fungi, and that it occurs among people of many different races scattered throughout the tropical and subtropical regions of the world, it is hardly surprising that there should be some variation in the radiological appearances which have been reported. Fortunately, in most cases the commonest picture is sufficiently distinctive to permit a confident diagnosis.

CONCLUSION AND SUMMARY

The radiological picture in 21 African patients with Madura foot admitted to Mulago Hospital, Kampala, Uganda, is described, and reports of two rarer manifestations of the disease are cited. The main characteristics of the more common type are: deep soft-tissue swelling, often with superficial nodules; irregular destruction from without, around the periphery of the affected bones (usually tarsals); sinuses within the spongiosa; a periosteal reaction which may resemble a palisade or the bristles of a brush; sclerosis of the affected spongiosa; osteoporosis distal to the affected bones; absence of true sequestra.

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SUMMARIO IN INTERLINGUA

Le Alterationes Ossee De Pede De Madura: Observationes In Negros De Uganda

Es describite le constatationes radiologic in 21 patientes african, admittite con pede de Madura al Hospital Mulago a Kampala in Uganda. Reportos de duo manifestationes plus rar del morbo es citate. Le characteristicas principal del typo plus commun del morbo es (1) tumescentia del profunde histos molle, frequentemente con nodulos superficial; (2) destruction irregular ab le exterior al peripheria del ossos afficite, usualmente le tarsales; (3) sinuses intra le spongiosa; (4) un reaction periosteal que pote resimilar un palisada o le pilos de un brossia; (5) sclerosis del spongiosa afficite; (6) osteoporosis distal al ossos afficite; e (7) nulle sequestros ver.

Bronchiolectasis in Chronic Bronchitis[1]

CARL P. WISOFF, M.D.

BRONCHIOLECTASIS is a manifestation of chronic bronchitis characterized by saccular dilatation of the terminal bronchioles. The more proximal bronchi may or may not show radiological changes. Zorini and Pigorini (1) first recorded the condition as "larval bronchiectasis" in 1934; in 1951 they reported that they had a personal experience with 100 cases. They recorded the clinical picture as one of chronic bronchitis in which hemoptysis is a prominent symptom. The chest films were negative, but the bronchograms showed small club-shaped or rosary-shaped distal branches. In the single case recorded by these writers symptoms were progressive and surgery was without apparent benefit.

Simon and Galbraith (2), in 1953, described the bronchographic findings in 90 patients with a clinical diagnosis of chronic bronchitis. The bronchographic observations consisted in dilatation, diverticulosis, and narrowing of the bronchi and pooling of the contrast medium in the terminal bronchioles. Peripheral pooling occurred in 26 cases, mainly in those with clinical evidence of emphysema.

The pathological changes in chronic bronchitis were reported by Reid (3) in 1954. The early cases were said to show hypertrophy of the mucus-secreting elements, and the more advanced disease, a purulent bronchiolitis. There were abscess cavities, obliteration of the bronchiolar lumen, and dilatation of the bronchioles which was diffuse or localized, with or without stenosis, partial or complete. Some cases were acute, while others were chronic, with scarring and compensatory volume changes in the alveoli. By injecting red lead into 5 of the specimens which showed peripheral pooling (Fig. 1), Reid (4) found that the lobulated bronchioles measured 3 to 5 mm. and arose from bronchioles measuring 1 mm. in diameter.

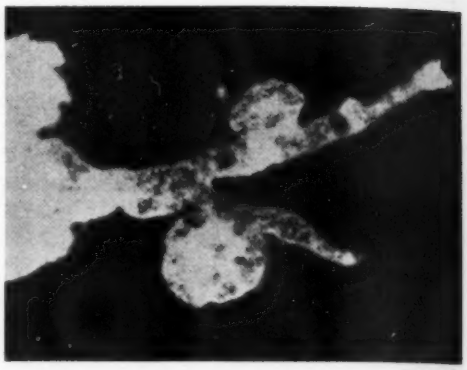

Fig. 1. Injection of red lead suspension into bronchus, showing peripheral "pool" of opaque medium. (From Lynne M. Reid: Thorax **10:** 201, 1955, by permission of the author and the publisher.)

The walls of these spaces were usually lined with respiratory epithelium and contained muscle and fibers confirming a bronchiolar origin. Sometimes the epithelium rested on a fibrous base, suggesting that, although distention is probably the most important factor, ulceration may also play a part in the production of the deformities.

CASE REPORTS

CASE I: F. B., a 39-year-old white automobile mechanic, complained chiefly of chest pain. About ten years earlier, he first began to have recurrent winter colds, characterized by coryza and cough. In 1951, 1952, and 1954, he had pneumonia. Fever, cough, chest pain, and dyspnea developed in November 1956, and about Dec. 6 the patient was admitted to Norfolk General Hospital, where he remained eleven days. During his hospital stay he had vague aches and pains in the chest and coughed up some tenacious mucopurulent sputum. There was no hemoptysis, fever, chills, or night sweats. The family history was noncontributory.

Physical examination was negative except for some fine crackling or moist râles in both lung bases. The white blood count ranged from 12,000 to 16,000, with an increase of polymorphonuclear leukocytes. Sputum culture showed *Neisseria catarrhalis* and alpha and beta *Streptococcus*. The electrocardiogram was normal.

[1] From the Norfolk General Hospital, Norfolk, Va. Accepted for publication in December 1957.

Films and fluoroscopy of the chest showed that the diaphragm was low, moving only slightly with respiration. The chest was otherwise normal.

Bronchograms showed peripheral pooling of contrast material in the terminal bronchioles, involving almost all the segments (Fig. 2). The patient continues to have severe dyspnea.

Fig. 2. Case I: Close-up view of the left upper lobe showing the bud-like terminal bronchioles.

CASE II: W. H., a 49-year-old white mechanic, complained of chronic cough and chest pain. He gave a history of asthma-like wheezing and chronic cough for about thirteen years. This cough sometimes brought up mucoid sputum, which occasionally was blood-tinged. The anterior costosternal portion of the chest was painful and tender. These complaints were chronic, with occasional episodes of acute upper respiratory infection.

The patient smoked two packs of cigarettes daily. The family history was noncontributory.

On the physical examination the heart and lungs appeared normal. Laboratory studies were noncontributory. Repeated chest films were negative. Chest fluoroscopy showed normal cardiac pulsation and movement of the diaphragm.

In May 1957, a bronchogram showed bud-like endings in the terminal bronchioles of the right upper lobe (Fig. 3). The other lobes were not involved.

DISCUSSION

In these patients the bronchiolectasis was the only manifestation of chronic bronchitis demonstrable, although other bronchographic changes have been described (2–7), such as narrowing and dilatation of the bronchi, nonfilling due to secretions, diverticulosis of the larger bronchi, and small spider-like shadows at terminal bronchioles. The severe dyspnea in Case I can be explained by the widespread involvement and nonfunction of the respiratory surface.

Fig. 3. Case II: Close-up view of right upper lobe showing small bud-like terminal bronchioles.

Case II showed pooling only in the right upper lobe, but no special attempt was made to fill all the terminal bronchioles. The disease may have been more widespread, as was frequently true of cases in which studies of pathological material were reported.

Reports of bronchiolectasis in the literature are too sketchy to determine its incidence in bronchiolitis or chronic bronchitis and emphysema, or the relation of this finding to the clinical symptomatology. The pathological findings, which in some cases have shown no chronic fibrotic changes, suggest that peripheral pooling may sometimes be reversible.

SUMMARY

Bronchiolectasis is a manifestation of chronic bronchiolitis or chronic bronchitis and is often associated with emphysema. It may be the only roentgen evidence of chronic bronchitis, even with severe symptoms. Two cases are presented.

ACKNOWLEDGMENT: The author is indebted to Drs. F. Bilisoly and A. Kaplan for permission to use the case histories.

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SUMMARIO IN INTERLINGUA

Bronchiolectasis In Bronchitis Chronic

Bronchiolectasis es un manifestation de bronchitis chronic, characterisate per dilatation saccular del bronchiolos terminal, con o sin alterationes radiologic in le bronchos plus proximal. Emphysema es frequentemente un constatation associate.

Es reportate duo casos in que le bronchiolectasis, demonstrate bronchographicamente, esseva le sol manifestation roentgenologic del bronchitis chronic. In ambe casos, symptomas referibile al thorace habeva essite presente durante prolongate periodos de tempore, sed le radiographias simple del thorace habeva parite normal.

Transintervertebral Retroperitoneal Gas Insufflation[1]

A. J. PALUBINSKAS, M.D.,[2] and C. J. HODSON, M.R.C.P., F.F.R.[3]

A TECHNIC FOR lumbar perirenal gas insufflation was presented by Rosenstein (4) and Carelli and Sordelli (1) in 1921. In 1950, Ruiz Rivas (3) introduced his method of retroperitoneal gas insufflation by the presacral route. More recently Bétoulières *et al.* (2) have mentioned the introduction of the gaseous medium into the subpubic space. The presacral technic described by Rivas appears to be the method most commonly employed today when retroperitoneal gas study is desired.

The essential feature of the Rivas technic is the insufflation of gas into the retroperitoneal tissues through a needle introduced into the presacral areolar tissue at any of several points on the skin adjacent to the bony coccyx. It is established practice for the operator to maintain an index finger in the patient's rectum during the procedure to insure proper retrorectal location of the needle. The purpose of the present article is to present a modification of the Rivas technic, introduced by Dr. C. J. Hodson and in use at University College Hospital, London, since December 1953. A total of 34 satisfactory retroperitoneal gas insufflations have been performed by this method without accident or untoward sequelae.

Fig. 1. Lateral coned-down view of the coccyx with radiopaque marker in place.

TECHNIC

The essential feature of the modified technic is the introduction of the insufflating needle into the retrorectal areolar tissues through one of the coccygeal intervertebral spaces.

In the normal subject, until the older age groups are reached, spaces are present between the sacrum and coccyx and often between the individual coccygeal vertebrae. These are not true intervertebral disk spaces such as are present above the sacrum but consist of ligamentous tissue, some fibrocartilage, and, in the case of the sacrococcygeal junction, sometimes a small "joint" space lined by synovial membrane. They vary in size, as well as in the direction of the transverse plane, but as a rule they can be traversed with a thin needle.

Patient Position: Any of the standard positions can be used. The prone position has been preferred, since it affords the patient maximum comfort and in no way interferes with the satisfactory execution of the procedure.

Preliminary Localization: The sacrococcygeal region is palpated, and the inter-

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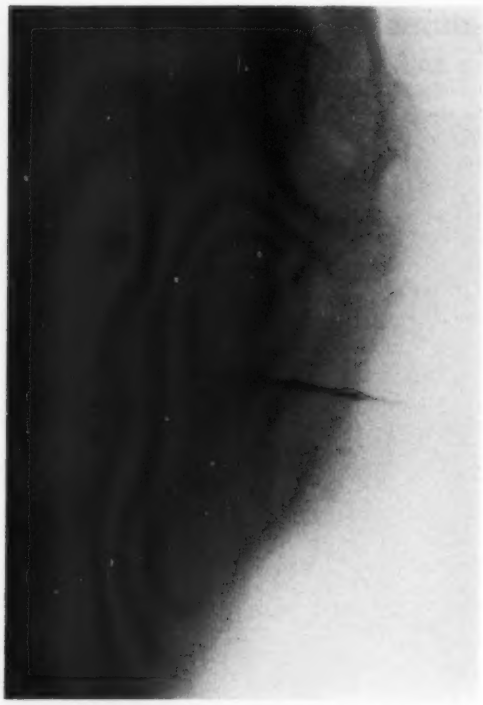

Fig. 2. Optional lateral coned-down view of the coccyx showing needle in position prior to gas insufflation.

vertebral spaces are thus identified; these are felt as slight transverse ridges situated in the angle between the upper part of the buttocks and are surprisingly easy of access. The one thought to represent the optimum level for injection is chosen and marked by a small radiopaque marker placed on or just to one side of the midline at this point.

A lateral coned-down film centered on the coccyx is then taken and immediately developed (Fig. 1). From this wet film the level of the intervertebral space most suitable for injection and its relation to the position of the marker can be determined. A mark to indicate its position is made on the skin of the buttocks on both sides of the midline.

The precise level of the selected space having been thus localized, the radiopaque marker can then be removed, and the patient's skin area prepared and draped in the usual fashion.

Needle Insertion: A local anesthetic is injected at the selected midline site down to the posterior surface of the coccyx. A 10-c.c. syringe is filled with sterile physiologic saline and attached to the insufflating needle. At University College Hospital a shortened 20-gauge lumbar-puncture needle has been found satisfactory, a short segment of thin rubber tubing being impaled on the needle shaft for use as a depth marker (Fig. 3).

The operator refers again to the wet film of the coccyx and estimates the angle of inclination of the chosen coccygeal intervertebral space from the vertical. With the needle and syringe inclined at this angle, the skin is entered at the selected midline point and the tip of the needle is advanced to the posterior surface of the coccyx. Usually little difficulty is encountered in identifying the interosseous space, since the feel of its soft tissue against the point of the probing needle is quite different from that of the adjacent hard bony coccyx.

The lateral film of the coccyx will show the operator the anteroposterior thickness of the vertebrae at the level of the selected intervertebral space, and he may thus judge the distance his needle has to be inserted in order to lie in the retrorectal areolar tissue. Once the intervertebral space has been located, the rubber marker is so adjusted on the needle shaft as to act as a rough guide to this depth of insertion. The needle is then carefully advanced through the "disk" space while, at the same time, gentle positive pressure is applied to the plunger of the saline-filled syringe. During its passage through the space no saline will leave the needle, since the compact cartilaginous tissue will prevent saline influx if only gentle positive pressure is maintained on the plunger.

Entry of the needle tip into the desired precoccygeal areolar tissues is marked by two simultaneous easily recognized endpoints: (*a*) a distinct "give" in the resistance to the passage of the needle, not unlike the sensation one obtains when piercing the posterior spinal ligaments during a lumbar

puncture; (*b*) a sudden easy flow of saline from the syringe.

Final Localization: An optional lateral film of the coccyx, similar to the first film, can now be taken for final verification of the position of the needle tip. This second film is reassuring to operators with little or no experience with the technic and in cases where any doubt exists as to the needle depth. The needle tip is usually shown to be lying in the retrorectal areolar tissue about 1 cm. anterior to the ventral surface of the coccyx (Fig. 2).

Saline Injection: The remainder of the original 10 c.c. of saline is now introduced into the retrorectal areolar tissues. This should flow in easily without resistance. It serves the multiple purpose of reaffirming the correct location of the tip of the needle, displacing slightly the posterior wall of the rectum away from the needle point, assisting in the establishment of a dissecting plane for the gas to be introduced, and of compressing any small vessels that may have been opened during the insertion of the needle. The patient is now ready for the insufflation of the chosen gas medium.

Gas Injection: Any of the methods of gas injection described and found safe can be used. Figure 3 illustrates the relatively simple apparatus employed at University College Hospital.

The remainder of the procedure, during and after gas insufflation, is not unlike that described elsewhere. At appropriate intervals during the course of insufflation the progress of the injected gas is observed under fluoroscopy, the patient's position is altered, either by tilting the table or simple positioning, to encourage adequate bilateral dissection, and appropriate spot films are taken. Following the introduction of gas, routine films of the abdomen are taken, and further combined diagnostic procedures such as tomography, intravenous urography, etc., are completed, when indicated.

It has been the custom at University College Hospital for an assistant to carry out continuous cardiac auscultation during the period of gas insufflation in order to detect any aberrations of heart sounds which might indicate gas embolization.

Fig. 3. Insufflating apparatus from gas source to insufflating needle.

DISCUSSION

The advantages of the transintervertebral technic for retroperitoneal gas insufflation are as follows:

1. Once properly inserted, the needle remains firmly fixed in its position by the intervertebral tissue, and easy movement and positioning of the patient are possible. If desired, a small artery forceps can be clipped across the needle at the skin level as a further precaution against its accidental forward movement once it is in position.
2. With proper execution of the technic it has been found unnecessary for the operator to insert and maintain an index finger in the patient's rectum during the procedure, with obvious relief to both operator and patient.
3. A comfortable prone position can be used.
4. The midline location of the injection site is such that even in obese individuals with large buttocks there is easy access, with minimal subcutaneous tissue to be traversed.

The disadvantages of the transintervertebral technic are as follows: 1. The procedure is slightly more time-consuming than the standard presacral technic. 2. At least one coned-down lateral view of the coccyx is required, and two such films are recommended for those unfamiliar with the technic.

SUMMARY

A modification of the usual method for presacral retroperitoneal gas insufflation has been described. Its essential feature is the insertion of the insufflating needle into the retrorectal areolar tissue space through one of the coccygeal intervertebral spaces. The advantages and disadvantages of the modified procedure have been described.

A total of 34 satisfactory retroperitoneal gas insufflations have been performed by this methed without accident or untoward sequelae.

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SUMMARIO IN INTERLINGUA

Insufflation Retroperitonee Transintervertebral De Gas

Le technica transintervertebral de insufflation retroperitonee de gas es un modification del methodo usual de insufflation retroperitonee presacral. Su characteristica essential es le insertion del agulia insufflatori in le histo areolar retrorectal per un del spatios intercoccygeo-vertebral. Le avantages e disavantages del methodo es discutite. Illo esseva usate in 34 casos con resultatos satisfactori.

Acute Radiation Changes in the Purkinje Cells

A Study of C3H Mice and a Patient Subjected to Fractionated Ionizing Radiation[1]

D. M. PERESE, M.D., W. T. MURPHY, M.D., and J. A. PARSONS, M.D.

ACUTE CHANGES induced in the Purkinje cells of rabbits by single massive doses (1,000 to 4,000 r) of ionizing radiation have been reported by Campbell *et al.* (2). In a similar study on rabbits, Russel (14) observed subacute changes three months after the administration of 2,850 r. She was unable to reproduce these results in the brains of mice treated under equal conditions. The study to be reported here deals with the early changes in the Purkinje cells of C3H mice subjected to total doses of radiation varying from 267 to 5,340 r (air dose) delivered in sixteen to thirty-two days. It is hoped that these findings may throw some light on the histopathological phenomena which may possibly occur in the human brain treated with fractionated radiation. One such case will be described.

MATERIALS AND METHOD

A total of 40 C3H mice weaned at two months and weighing 19 to 22 gm. each was used. C3H mice were chosen because Reinhard (13) had reported that mice of this strain survived a single x-ray dose of 1,400 r to the head, while dba mice tolerated only 500 r. Thus a larger dose of radiation could be given before maximum tolerance was reached.

One-half of the 40 mice were irradiated and the other half served as controls. The anesthetized animal was placed in a prone position on the surface of a firm cotton pad 3 cm. thick, covered by oilcloth and a paper towel. This pad rested on a wood table top of 2 cm. thickness. A lead plate 2 mm. thick and 15 × 15 cm. in area was placed over the animal, with only the head exposed through an 11 × 11-mm. aperture. A circular treatment cone of 4.2 sq. cm. was used. Treatments were given Monday through Friday, with a 100-kvp generator, with a half-value layer of 1.4 mm. aluminum, at 18 cm. skin-focus-distance. The dose rate was 246 r per minute measured in air. Each mouse (both experimental and control) was anesthetized with 1.2 mg. of Sodium Nembutal injected intraperitoneally before irradiation.

On the first day, all 20 experimental mice were irradiated. On each succeeding treatment day one less mouse was treated, so that on the twentieth day, only 1 was irradiated. Each animal, together with its control, was sacrificed on the day following its last treatment. Thus, the first mouse received 267 r and the twentieth mouse received 5,340 r. During their lifetime, the mice were kept in groups of 5 per cage and were given the same food and care as the control animals.

Immediately after the animal was sacrificed, the head was separated from the body and the brain was removed and divided in half through an incision along the longitudinal fissure. One-half was prepared for staining by hematoxylin and eosin, the other half for Elftman's (4) modification of the Golgi stain.

In addition to the animal studies, we were fortunate enough to obtain biopsy specimens of the cerebellum from a patient undergoing craniotomy in the posterior fossa for trigeminal neuralgia, and from another patient whose cerebellum had received radiation during rotational therapy of the pituitary gland. In this latter case, the biopsy specimen was removed twenty-four hours after the completion of radiotherapy. These human brain specimens were stained in the same way as the tissue from the experimental mice.

[1] From Roswell Park Memorial Institute, Buffalo, N. Y. Accepted for publication in December 1957.

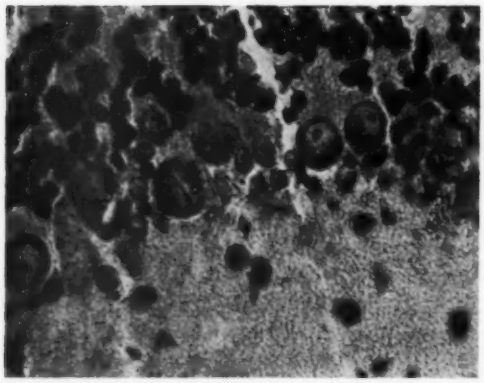

Fig. 1. Golgi and hematoxylin-eosin stain in the control mouse receiving one dose of Nembutal but no radiation. The Golgi network surrounds the nucleus, filling the entire cytoplasmic area. × *c.* 575.

The histopathologic evaluation of the changes in the cerebellum, particularly in the Purkinje cells, was made by first studying the slide stained by hematoxylin-eosin and then the Golgi-stained slide. Both were compared with the control specimens. Particular attention was paid to the Purkinje cells because of their easy vulnerability to poisons, etc. (8, 10). The Golgi-stained Purkinje cells were counted under oil, at 97 × 15 magnification. For counting, a 10-mm. square reticule divided into 400 squares was used. Each square measured 25 square micra. The slide was moved into position, so that the direction of the alignment of the Purkinje cells was at a 90° angle to the vertical axis of the reticule. All the cells within the reticule were counted. The slide was then moved beyond the last counted cell, following the contour of the folia and keeping the alignment of the cells at the same angle to the vertical axis of the reticule, until the counting was completed in 500 reticules. In other words, the Purkinje cells stained with silver and demonstrating the Golgi network were compared in the treated as well as in the control group.

Although the morphologic and histochemical nature of the Golgi apparatus has been questioned (1, 7), a difference in the appearance of the network between the irradiated and control specimens can be demonstrated while the method of preparation is kept constant. The Golgi-stained slides make possible a demonstration of degenerative changes such as retispersion and retisolution, which are indications of varying degrees of cell damage (12). As Elftman has pointed out, the silver impregnation of the Golgi apparatus is a powerful tool in studying the functional alterations within the cytoplasm.

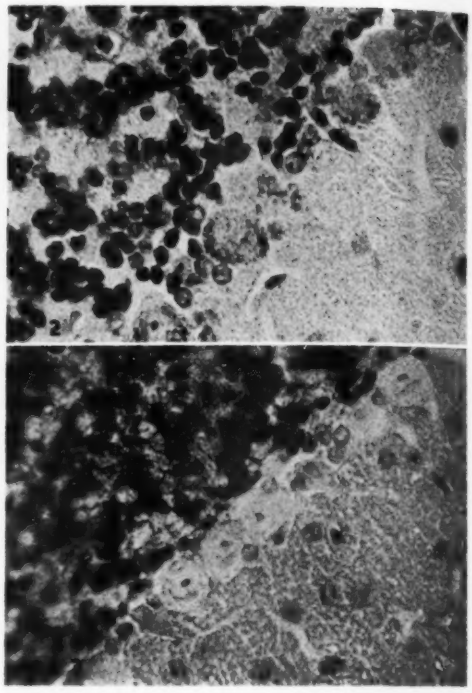

Fig. 2. Golgi and hematoxylin-eosin stain. This animal received a total of 2,670 r over a period of two weeks in daily increments of 267 r. The Golgi network shows varying degrees of fragmentation indicating retispersion and retisolution. × *c.* 500.

Fig. 3. Golgi and hematoxylin-eosin stain of the cerebellum of the mouse that received a total of 5,340 r over thirty-two days in increments of 267 r. Note complete absence of the Golgi network in the Purkinje cells and coagglutination of the granular cells. × *c.* 525.

RESULTS

The hematoxylin and eosin preparations in the irradiated mice showed no marked abnormality as compared with the controls (Figs. 1 and 2), except for the 1 mouse which received 5,340 r (Fig. 3). In this mouse an occasional Purkinje cell showed vacuolization and edema. Others ap-

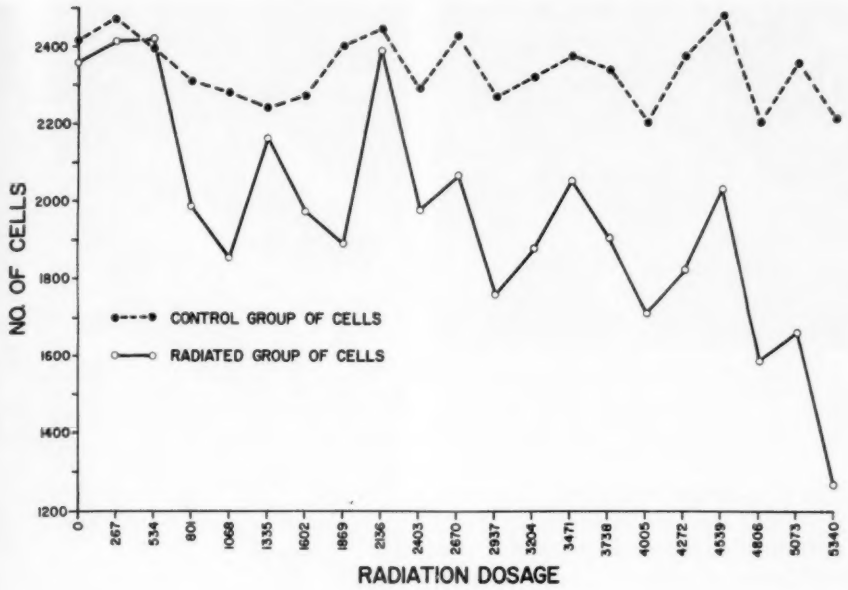

Chart I

peared smaller and narrower than the normal Purkinje cell, which is 10 to 15 micra in length. The Golgi preparations which were counterstained with hematoxylin-eosin revealed changes which were not present in the control animals. Alterations in the general structure of the Golgi network, such as retispersion and retisolution, were observed in mice receiving increments of radiation beyond the level of 2,670 r. The greatest degree of retisolution occurred in the mouse receiving 5,340 r.

In some of the Purkinje cells, the Golgi network was completely absent (Fig. 3). We were able to recognize these cells by the counterstain used to outline the nuclei. Those cells without any recognizable Golgi network were not included in the counting. All the Purkinje cells with a barely recognizable network of Golgi apparatus were included in the count. The number of silver-impregnated Purkinje cells in the irradiated mice varied from 1,268 to 2,180 per 500 reticules counted. The lowest count occurred in the mouse receiving the highest dose of radiation, 5,340 r (Chart I). A comparable count in the control series varied between 2,215 and 2,490. One can deduct that the drop in the number of Purkinje cells was close to 50 per cent in the mouse receiving the most radiation.

DISCUSSION

In evaluating the effects of radiation on normal tissue such as brain, one must consider the two factors outlined by Warren (15): (*a*) the size of the field of exposure; (*b*) the rate of irradiation.

This study was planned to test the immediate effect of varying total doses of equally fractionated radiation. In nearly all the other investigations designed to test the effect of ionizing radiation in experimental animals, massive single doses have been used (3, 11). We are unaware of a similar report on the Golgi apparatus of the Purkinje cells of C3H mice. Other studies, such as those on the effect of large doses of x-radiation on the Golgi apparatus of experimental animal carcinomas (5, 9) and on the Golgi network of the spermatocytes of *Abraxas grossulariata* do not lend themselves to comparison with our work. Nevertheless Fogg (5) and Ludford (9) brought out the fact that, following a dose

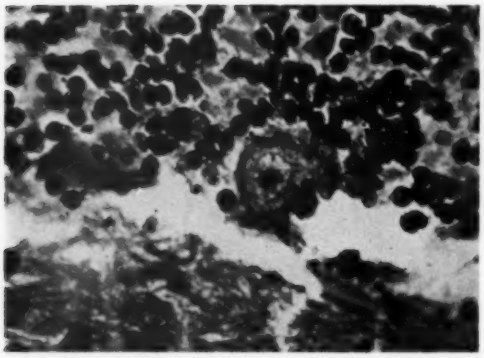

Fig. 4. Golgi and hematoxylin-eosin stain. This patient received 800 r (h.v.l. 7.6 mm. Pb) within twenty-three days to the site of a cerebellar biopsy during rotational irradiation of the pituitary gland. Note the retispersion of the Golgi network. × *c.* 525.

of 1,600 r in a single treatment, the Golgi apparatus had lost its identity and was broken up into variable units when it was examined between eighteen and twenty-four hours after irradiation.

The human cerebellar specimen removed twenty-four hours after a total dose of 800 r delivered within twenty-three days showed evidence of retispersion in the Golgi network (Fig. 4) comparable to that found in the mouse which received 2,670 r within sixteen days. The patient who had not received any irradiation showed a normal histologic pattern (Fig. 5).

The congestion of the capillaries and the fresh bleeding in the cerebellum of the irradiated patient were similar to those observed in the mice receiving the higher doses of radiation. (During the removal of the cortical biopsy specimens, no electrocautery was used. The specimen was obtained with a sharp scalpel, and the bleeding was brought under control after the specimen was removed.)

Our method of administering the radiation differed from that of Ludford (9) and Fogg (5). The alteration in the configuration and the position of the network of the Golgi apparatus which they found is similar to the changes observed in the C3H mice and the irradiated patient. The significance of this alteration in terms of functional impairment cannot be stated definitely. Neither the mice nor the patient

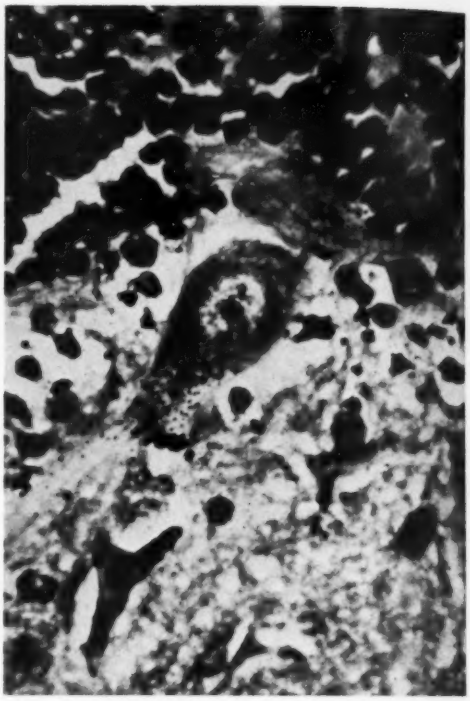

Fig. 5. Golgi and hematoxylin-eosin counter stain. A Purkinje cell of a patient with a normal Golgi network. × *c.* 700.

showed any evidence of neurologic impairment. The speed of the righting reflex of each mouse was timed daily, and the patient was checked at two-week intervals. Although retisolution of the Golgi network is compatible with severe nerve cell damage (12), Purkinje cells remaining are evidently able to resume and carry on the function delegated to the cerebellum in the presence of even 50 per cent diminution of their original number.

SUMMARY

1. The craniums of 20 C3H mice were irradiated with total roentgen doses varying from 267 to 5,340 r, fractionated into daily doses (in air) of 267 r (h.v.l. 1.4 mm. Al, 100 kvp).

2. Twenty control mice received the same dose of barbiturate as the irradiated animals and were killed simultaneously, twenty-four hours after the last exposure of the experimental group to x-radiation.

3. The brains of the mice were stained with hematoxylin-eosin and Golgi stains. The silver-impregnated Purkinje cells were counted and the Golgi network was studied.

4. The mice receiving between 2,670 r and 5,340 r within sixteen to thirty-two days showed various degrees of retispersion and retisolution of the network. There was a sudden drop in the number of Purkinje cells to 50 per cent of normal when the total dose reached 5,340 r. However, the animal showed no recognizable alteration in behavior.

5. Similar acute changes were observed in the Golgi network of the Purkinje cells of a patient receiving 800 r within twenty-three days.

NOTE: We express our appreciation to Dr. Chi Chu, Mrs. Mary Northington, Mrs. Hedvig Norberg, and Mrs. Isabelle Herger for technical assistance.

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SUMMARIO IN INTERLINGUA

Acute Alterationes Per Irradiation: Un Studio Del Cellulas De Purkinje In Muses G3H E In Un Patiente Subjicite A Fractionate Radiation Ionisante

Le cranios de 20 muses C3H esseva irradiate con doses total de radios roentgen variante inter 267 e 5.340 r, fractionate in doses diurne (in aere) de 267 r. (Spissitate de medie valor = 1,4 mm de Al; 100 kvp.) Un secunde serie de 20 muses serviva como subjectos de controlo. A partir de 24 horas post le initiation del irradiation, un animal esseva sacrificate diurnemente, de maniera que le effecto de dosages progressivemente augmentate poteva esser studiate. Le muses de controlo esseva sacrificate simultaneemente, 24 horas post le ultime exposition a radios roentgen in le gruppo experimental.

Le cerebros del muses esseva tincturate con hematoxylina-eosina e colorante de Golgi. Le cellulas de Purkinje, impregnate de argento, esseva contate, e le rete de Golgi esseva studiate.

Le muses recipiente inter 2.670 e 5.340 r intra inter 16 e 32 dies monstrava varie grados de retispersion e de retisolution. Occurreva un reduction subitanee del numero de cellulas de Purkinje—usque a 50 pro cento del numero normal—quando le dose total attingeva 5.340 r. Tamen, le animales monstrava nulle evidente alteration de comportamento.

Simile alterationes acute esseva observate in un patiente qui habeva recipite 800 r intra 23 dies.

Cavernous Hemangioma of the Gastrointestinal Tract

Report of a Case and Review[1]

ROBERT MARINE, M.D.,[2] and W. W. LATTOMUS, M.D.

CAVERNOUS HEMANGIOMA of the gastrointestinal tract is a rare lesion. Though it is frequently fatal, it is practically always curable. Its preoperative recognition is therefore of importance. Fortunately, many of these lesions present a recognizable roentgenologic appearance.

Phleboliths have been reported in cavernous hemangioma of the stomach and colon and, when present, are highly suggestive of the diagnosis. Hansen, in 1948, wrote: "Phleboliths are said to be common and are often an important diagnostic point [in diffuse infiltrating cavernous hemangioma of the small bowel] but in no reported case of this type has the presence of phleboliths been mentioned." Ochsner and Penick have also commented on this omission as recently as 1957. It is felt worthwhile, therefore, to report a case of jejunal hemangioma exhibiting numerous phleboliths in preoperative roentgen studies.

The most widely accepted classification of gastrointestinal hemangiomas is that of Kaijser, as follows:

I. Multiple phlebectasia
II. Cavernous hemangioma
  A. Diffuse infiltrating
  B. Circumscribed, often polypoid
III. Simple capillary hemangioma
IV. Angiomatosis

The second type, cavernous hemangioma, is the subject of this paper. The diffuse infiltrating form causes hemorrhage frequently and obstruction occasionally. Phleboliths are said to be common in this group and can be demonstrated roentgenologically. The small intestine, colon, and rectum are the most common sites of the lesion in the alimentary tract, but the stomach is sometimes involved, and even the esophagus and appendix may be affected. When obstruction occurs from this type, it is usually the result of intussusception. Phleboliths occur also in the circumscribed forms, but less commonly. The phleboliths may be homogeneous or layered.

CASE REPORT

A 7-year-old girl was admitted to the Delaware Hospital on Jan. 25, 1952. Her mother stated that the child had been weak from birth and always seemed tired. These symptoms became worse several months before admission and were so severe that the child had to be carried about. She had always been pale. The history was otherwise unremarkable.

Admission blood studies revealed a hemoglobin of 8.8 gm. and a red blood cell count of 2,900,000. The total white blood cell count was normal, but there was a marked eosinophilia. The hematocrit value was 34 per cent, and the reticulocyte count 5 per cent. Other blood findings were normal.

Various roentgen studies, not including a small bowel series, were normal.

The parents became dissatisfied and removed their daughter from the hospital against medical advice. For nearly three years thereafter she remained pale, weak, and tired. She was then readmitted because of periumbilical pain and vomiting. The vomitus was not bloody. The pain was dull and nonradiating, and its onset was followed usually by passage of a tarry stool. Laboratory studies again showed a severe anemia, and there was a strongly positive test for occult blood in the feces.

Roentgen studies of the upper gastrointestinal tract and the colon were normal. A small bowel series showed one jejunal loop separated from the remainder of the small bowel. The contour and density of the loop were irregular, and its lumen was narrowed. Adjacent to it were many small rounded densities, which appeared to be phleboliths (Fig. 1).

At laparotomy a diffuse cavernous hemangioma was resected, with a portion of jejunum 24 cm. in length. On the serosal side it was a port wine color and at the mucosal surface it was tan. There were numerous excrescences on both sides, which bled freely on being punctured. The specimen weighed 253 gm. before exsanguination and 73 gm. afterward. This weight loss represents a blood loss of 172 c.c.

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Fig. 1. Small-bowel film at one hour, showing numerous phleboliths adjacent to a jejunal filling defect.

Many phleboliths were found in the specimen. The histologic diagnosis was cavernous hemangioma.

In more than two years of postoperative observation, the girl has been healthy.

REVIEW

Vascular tumors of the gastrointestinal tract are unusual. Most of those occurring are benign in their cellular structure but are dangerous because of their tendency to bleed. Cavernous hemangioma is a rare type in this rare group and is especially dangerous. In a few of the reported cases there have been associated skin hemangiomas. Various theories have been proposed to explain the etiology of these tumors. None has been proved, but the two prominent ones are: (*a*) that they are true tumors, capable of autonomous growth; (*b*) that they are congenital malformations.

Stomach: Flannery and Caster have published an excellent review of hemangioma of the stomach. They state that hemorrhage and anemia are the most prominent findings. Epigastric pain and obstruction occur occasionally, and the lesion may mimic peptic disease, gastritis, or a neoplasm. Any portion of the stomach may be involved, and the lesions may be multiple. Sarcomatous change is quite rare. Twenty-five cases previously reported are reviewed by these authors and they add a twenty-sixth. In their patient, the diagnosis was established preoperatively by the roentgen demonstration of phleboliths adjacent to a gastric filling defect.

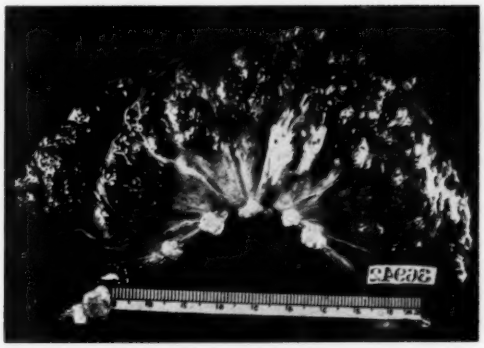

Fig. 2. Jejunal hemangioma with phleboliths: gross surgical specimen.

Small Intestine: Cavernous hemangioma has been found in all portions of the small intestine, but it is less frequent in the duodenum than in the jejunum and ileum. Melena and anemia are the most common problems. Obstruction may occur but is not usual.

Hansen, in a comprehensive review, found 23 cases of cavernous hemangioma involving the small bowel reported up to 1946. To this number he added 2 examples. Since then, there have appeared in the literature, in English, at least 22 more, including the present case (3, 4, 6–8, 11, 16–19). In the series collected by Hansen, phleboliths were found once, in a case of circumscribed cavernous hemangioma; none were found in association with the infiltrating type. The phleboliths in the 1 case were not shown by x-ray studies but by examination of a surgical specimen. Among the 22 cases reported subsequent to Hansen's article, were 2 with phleboliths. Butler, Tillisch, and Priestley reported 1 of these, the stones being found in the resected specimen. In the case re-

ported here a small bowel series showed the phleboliths clearly.

Symptoms of hemorrhage or obstruction were present in most of these cases. In a few, the diagnosis was made incidentally at autopsy and no history of symptoms or signs related to the hemangioma was obtained. Physical findings and laboratory values usually reflect only the bleeding or obstruction. An occasional patient will have an abdominal mass. An associated hemangioma of the skin may occur. Roentgen findings other than the demonstration of phleboliths include filling defects, narrowing or complete obstruction of the bowel lumen, intussusception, and regional dilatation.

Colon and Rectum: Many cavernous hemangiomas of the colon and rectum have been reported without mention of phleboliths (6). In 1951 Hollingsworth published a case in which the diagnosis was established preoperatively because of this feature. This was the first such case for the colon; since then at least 6 more have been published (1, 2, 10, 13, 14).

Characteristically hemangioma of the colon causes melena, anemia, passage of mucus, and sometimes tenesmus. Bleeding is often severe. The appendix and all portions of the colon and the rectum have been found involved, the rectum being the most common site. Care must be taken to avoid confusion with hemorrhoids.

SUMMARY

Phleboliths are known to occur in hemangiomatous lesions in all portions of the gastrointestinal tract; their presence is a valuable diagnostic point. Phleboliths are normally seen in the venous plexuses of the parametrial, bladder, and prostatic areas and occasionally in the spleen; when observed elsewhere they suggest cavernous hemangioma. In patients with gastrointestinal bleeding or obstruction of obscure origin, this point may be helpful. In addition, one should remember that gastrointestinal hemangioma is sometimes associated with hemangioma of the skin.

ADDENDUM: After this article was ready for publication, an additional case was reported, of angioma of the ileum and its mesentery.[2] The preoperative diagnosis was established primarily on the basis of the roentgen finding of phleboliths adjacent to a small-bowel filling defect.

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SUMMARIO IN INTERLINGUA

Hemangioma Cavernose Del Vias Gastrointestinal: Reporto De Un Caso, Con Revista Del Litteratura

Hemangioma cavernose del vias gastrointestinal es un lesion infrequente. In multe casos illo es associate con phlebolithos, e le demonstration de tales es un importante puncto diagnostic, specialmente in le presentia de sanguination gastrointestinal o de obstruction a origine obscur.

Es reportate un caso in un puera de dece annos de etate qui habeva un historia de debilitate e de pallor depost su nascentia. Roentgenogrammas monstrava un ansa jejunal separate ab le resto del intestino tenue, con numerose phlebolithos in sitos adjacente. Al operation un diffuse hemangioma cavernose esseva resectionate insimul con un segmento de jejuno que mesurava 24 cm. Le patiente se restabliva.

"Negative" Bone Density in a Case of Multiple Myeloma

DANIEL J. TORRANCE, JR., M.D.

THE POSSIBILITY OF bone being less dense radiographically than the surrounding soft tissues seems, on the face of it, extremely remote. Accordingly, it is felt worthwhile to report a case with such marked demineralization of the spine that this unusual condition was fulfilled.

When first seen in the spring of 1947, a 55-year-old housewife gave a history of moderately severe back pain for a year and a half. She was admitted for laboratory study, after extensive osteoporosis had been demonstrated roentgenographically. The serum protein was elevated (total 10.1 gm. per cent, with an A-G ratio of 4.8/5.3). If allowance is made for this finding, the calcium, phosphorus, and alkaline phosphatase activity were within normal limits (calcium 11.7 mg. per cent; phosphorus 4.7 mg. per cent; alkaline phosphatase activity 4.0 units). The roentgen changes were the most unusual manifestation of the disease. The osteoporosis was so extreme that the vertebral bodies appeared radiolucent in comparison with the surrounding soft tissues (Fig. 1). The skull films showed irregular demineralization (Fig. 2).

On the basis of the clinical and x-ray findings, a diagnosis of multiple myeloma was suggested. There was no evidence of proteinuria during the course of the disease. Biopsies of the sternal and iliac marrow were performed. The operative note reads, in part: "Several curettes of the sternal marrow, which appeared to be thoroughly fatty, were taken." The microscopic report is as follows: "All sections of the marrow reveal normal cellular elements. There seems to be a slight increase of the immature cells, as well as an increase in the amount of fat which is found in the marrow sections." Additional sections were cut. On review, the series demonstrated a few accumulations of plasma cells, and plasma-cell myeloma was suggested as a possible diagnosis.

Clinically, the diagnosis was regarded as firm, and the patient was treated empirically with several courses of estradiol propionate during her two-year period of observation. She improved strikingly at first, regaining much lost weight. Bone pain disappeared and she resumed full activity, though corresponding objective change in the bones was never observed radiographically. After this initial benefit, she began to lose ground, and subsequent courses of estradiol had progressively less effect.

Fig. 1. Lateral view of a portion of the dorsolumbar spine showing extreme osteoporosis, amounting to actual "radiolucency" of the vertebral bodies.

The patient was readmitted in August 1949, about two years after her first admission, with a pathological fracture of the right hip. She was weak, emaciated, and evidently in a terminal state. Death occurred a few days later. Autopsy permission was not granted.

DISCUSSION

The distinctive feature of this case is the unusual radiolucency of the vertebrae, the bone density being less than that of the soft tissues. On physical grounds, such radiolucency appears to be most readily explained on the basis that the marrow cavity was almost entirely filled with fat. This not only indicates fatty alteration of the normal vertebral marrow but seems to be

[1] From the Department of Radiology, Johns Hopkins Hospital, Baltimore, Md. Accepted for publication in December 1957.

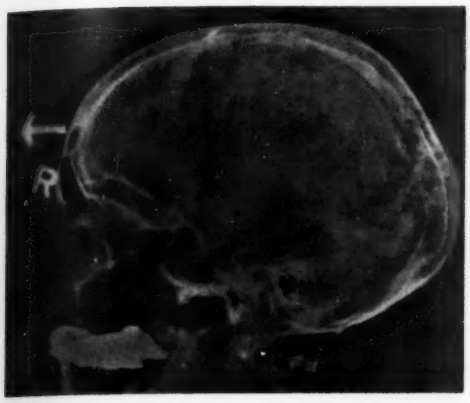

Fig. 2. Punched-out areas of destruction in the skull.

opposed to the diagnosis of extensive myelomatous infiltration, since myeloma proteins should not be relatively radiolucent. It is of special interest that both the gross and microscopic biopsy notes indicate a fatty marrow. The findings in such a case as this support the idea that much of the osteoporosis in multiple myeloma may not be associated with marrow replacement by myeloma cells.

SUMMARY

A case of extreme demineralization of the lumbar vertebrae is described. The unusual feature of the case is that the vertebral bodies were demineralized to an extent sufficient to make them less dense radiographically than the intervertebral disks and the surrounding soft tissues. This finding, for which no precedent could be found in the literature, is taken to indicate a fatty marrow and may be of some clinical significance in the differential diagnosis of osteoporosis.

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SUMMARIO IN INTERLINGUA

"Negative" Densitate De Osso In Un Caso De Myeloma Multiple

Es describite un caso de extreme dismineralisation del vertebras lumbar. Le aspecto inusual del caso es le facto que le corpores vertebral esseva dismineralisate a un grado sufficiente pro render los minus dense in le radiogramma que le discos intervertebral e le circumjacente histos molle. Iste non-precedentate constatation es interpretate como un indication de medulla grasse e es possibilemente de alicun signification clinic in le diagnose differential de osteoporosis.

Calcified Hydropyonephrosis[1]

SAMUEL LEWIS, M.D., and R. DOUGLAS DOSS, M.D.

IT IS SELDOM that one has the opportunity to see the end stage of a serious illness of many years duration completely unmodified by treatment.

REPORT OF A CASE

F. T., a former steelworker, 69 years old, was admitted on May 25, 1956, complaining of weakness and shortness of breath of one week duration. Diabetes had been discovered in 1947 and had been treated by diet and 30 units of insulin daily. There was no history of hypertension or any previous illness of consequence.

The pertinent findings on physical examination were as follows: blood pressure 150/90 mm. Hg; bilateral arcus senilis; coarse rales in the lungs; pretibial and ankle edema. The liver was palpable three finger breadths below the right costal margin.

Urinalysis showed moderate proteinuria and glycosuria. At times, fine and coarse granular casts were present. The nonprotein nitrogen was 101 and the blood glucose was 59 mg. per 100 c.c. The red blood cells numbered 2,900,000 per c. mm., with 9.5 gm. of hemoglobin. The white blood count was 5,400, with a normal differential.

Roentgenograms of the chest showed a minimal right pleural effusion. A calcified, lobulated cystic mass was demonstrable in the abdomen (Fig. 1).

The calyceal nature of the structure was recognized and a diagnosis of calcified hydropyonephrosis was made. Echinococcus cysts were considered, but would not have produced the anatomic pattern here observed.

The clinical course was one of steady deterioration. Increasing acidosis developed, and the patient died on June 16, 1956.

At necropsy, the pertinent findings were confined to the kidneys. The right kidney weighed 600 gm. and appeared as a lobulated calcified shell. On cut section, the lobulated areas measured 3 to 4 cm. across, the cavities being filled with yellow, putty-like material. The pelvis could not be recognized. The ureter was greatly dilated on this side, and kinked by fibrotic bands 2 cm. from the bladder orifice and 4 cm. from the ureteropelvic junction. The left kidney weighed 250 gm. The capsule stripped with ease. The cortical surface was yellowish tan

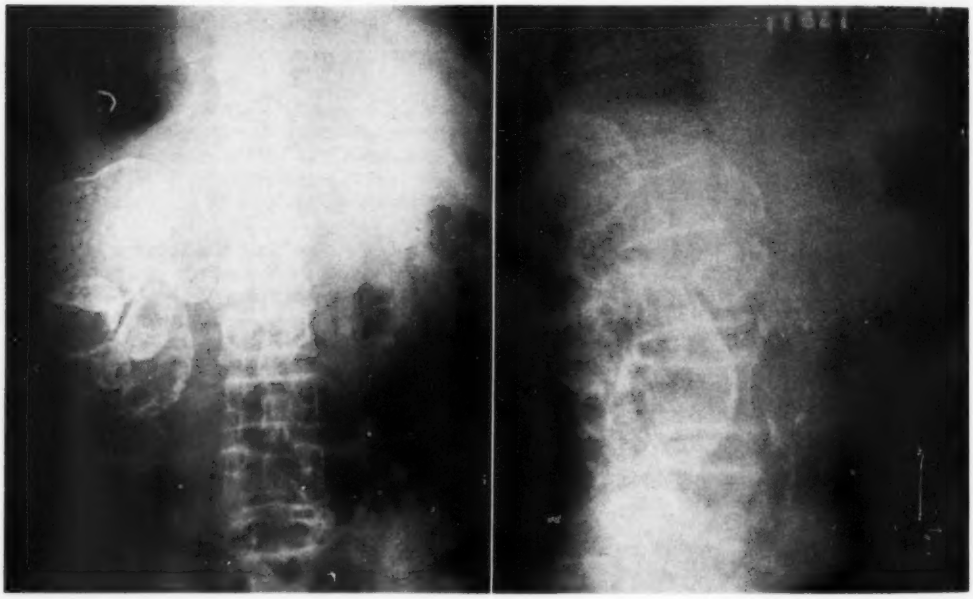

Fig. 1. Abdominal films showing lobulated cystic mass.

[1] From The Radiology Service, Veterans Administration Hospital, Pittsburgh, Penna. Accepted for publication in November 1957.

and coarsely granular. On cut section, the surface bulged. The pelvis and ureter appeared normal. Microscopic sections of the left kidney disclosed interstitial fibrosis, edema, and marked thickening of the arterioles. The tufts showed varying degrees of membrane thickening, with hyaline ball formation.

The pertinent autopsy diagnoses were intracapillary glomerulosclerosis of the left kidney, old calcified hydronephrosis of the right kidney, fibrous strictures of the right ureter, and uremic pericarditis.

Reconstructing the sequence of events in this case, it would seem that chronic hydronephrosis had developed as the result of strictures of the ureter with consequent low-grade infection and eventual healing by calcification. Symptoms prior to the terminal illness had never been sufficiently severe to bring the patient to a physician.

A search of the literature through a period of ten years did not reveal any similar case.

SUMMARY

A case of calcified hydropyonephrosis, secondary to stricture of the ureter, is described.

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SUMMARIO IN INTERLINGUA

Hydropyonephrosis Calcificate

Es reportate un caso de hydropyonephrosis, vidite in su stadios terminal. Le condition habeva durate multe annos, sed le symptomas ante le maladia terminal non habeva unquam essite satis sever pro inducer le patiente a consultar un medico. Super le base de un reconstruction del sequentia del eventos, il pare que hydronephrosis chronic se habeva disveloppate como resultato de stricturas ureteral, con consequente basse grados de infection e curamento gradual per calcification.

Adaptation of Polaroid X-Ray Paper Prints to Radioisotopic Scanner Technics[1]

ISADORE MESCHAN, M.D.,[2] and C. FRED TAYLOR, M.D.[3]

SCANNER TECHNICS play an essential role in certain studies concerned with radioisotopes. Although at present radioisotopic scans are largely confined to the thyroid gland, they are finding increasing application to the brain, liver, and other organs. It is conceivable that still other scanning procedures will come to the fore as certain radioisotopes are found to localize in specific organs and viscera.

When a hash-mark type record is employed in conjunction with such scanner technics, it is customary to indicate by a relatively crude diagram certain landmarks which will help locate the scan in relation to the anatomy. We have been able to improve this anatomic depiction as follows:

Immediately prior to obtaining the scanogram, a radiograph of the part to be studied is obtained (usually with a grid) with a polaroid x-ray apparatus. Ordinarily this gives one an immediate paper-type radiograph, which, although lacking in the minute detail obtained with a film transparency, is entirely adequate for portrayal of the skeletal parts and their relationships. The radiograph is aligned in the scanner with the patient.

When the hash-mark record is obtained, the hash-marks are recorded, *through carbon paper, on the back of the polaroid paper radiograph*, since one cannot obtain a good hash-mark record on the glossy surface of the print. Once the hash-mark record is complete, it is a simple matter to transilluminate it on the x-ray illuminator, and anatomic relationships are immediately visualized. One must, however, exercise some care in lining up the polaroid radiograph initially with respect to certain landmarks such as the clavicle in the case of the thyroid gland.

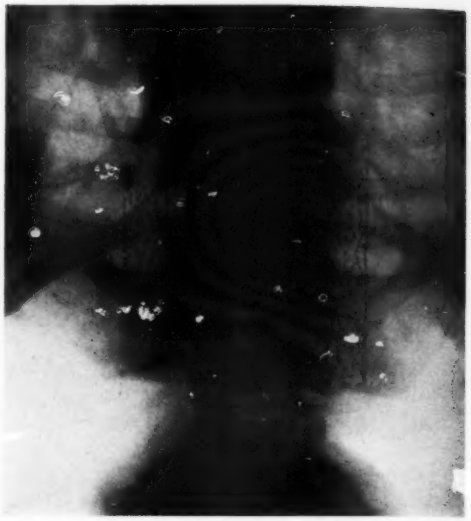

Fig. 1. Polaroid radiograph, transilluminated, showing hash-marks.

The accompanying figure illustrates the appearance when the polaroid radiograph is transilluminated, showing the hash-marks projected on the reverse side of the radiograph. At the time the radiograph is obtained, one can indicate various nodules with lead markers and in this fashion obtain an accurate record of the selective uptake or lack of uptake in the areas in question. This greatly improves the accuracy of the scanograph.

This technic has been applied to the abdomen and also to the brain when scanograms have been attempted. Grid films of these areas improve the quality of the radiographs.

SUMMARY

A technic is described for utilizing a polaroid radiograph as the background for

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the hash-mark type of scanogram. One can thus accurately depict the localization of isotopes in nodules, for example in the thyroid gland, in relation to the rest of the structure (to the limit of the resolution of the apparatus). It is also possible to determine accurately the localization with reference to the manubrium or the substernal area.

This method of obtaining scanograms is believed to be a definite improvement over merely indicating by crude adaptation certain landmarks in relation to the various scans obtained.

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SUMMARIO IN INTERLINGUA

Adaptation De Copias A Papiro Roentgenographic Polaroide A Technicas De Scansion Radioisotopic

Es describite un technica pro le utilisation de un radiographia polaroide como fundo del typo hachurate de scanogramma. Assi on pote depinger accuratemente le localisation de isotopos in nodulos—per exemplo in le glandula thyroide—in relation al resto del structura. Il es etiam possibile depinger accuratemente le localisation con referentia al manubrio o al area substernal.

Iste methodo pro obtener scanogrammas es representate como un melioration definite in comparation con le methodo de mermente indicar, per un adaptation crude, certe punctos de orientation in relation al varie scansiones obtenite.

Isolated Pulmonary Artery Coarctation and Pulmonary Hypertension[1]

KARL H. FALKENBACH, M.D., NORMAN ZHEUTLIN, M.D., and BERNARD J. O'LOUGHLIN, M.D., Ph.D.

Radiologic studies on children with pulmonary hypertension disclosed 4 instances in which the only associated abnormality was a coarctation of one branch of the pulmonary artery. In the past this has been considered a rare congenital anomaly. In seeking to establish a causal relationship, similar unilateral constrictions were produced in dogs.

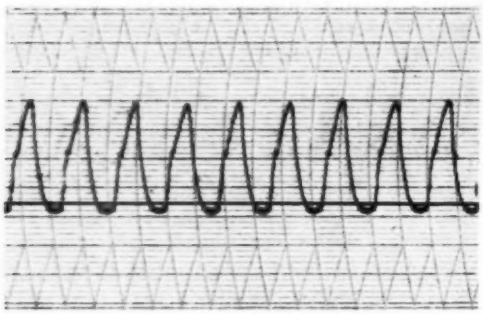

Fig. 1. Tracing of the right ventricular pressure in a dog with acquired pulmonary hypertension. Pressure of 120/3 is based on calibration of 30 mm. mercury per line.

The first branch of the pulmonary artery was constricted in 5 young puppies. After several months, pulmonary arterial pressure was measured by catheter and strain gauge manometer. Pulmonary angiographic studies were then performed and these clearly demonstrated the constrictions which had been induced. Correlative histologic studies are being done on the dogs which succumbed. The results of these preliminary studies have been very encouraging.

Pulmonary arterial pressure and/or right ventricular pressures were elevated in four of the five young dogs studied. (Fig. 1, a typical pressure curve from the right ventricle, shows an elevation from the normal 30 mm. Hg systolic to 120 mm. Hg systolic.) The pressures produced ranged from 75 to 175 mm. Hg. Subsequent angiocardiograms showed a unilateral constriction in one pulmonary artery of all the hypertensive dogs (Fig. 2). The one dog which did not have pulmonary hypertension had had its left pulmonary artery completely obstructed several months earlier at the time of surgery. Confirmatory angiograms on this dog showed only one patent branch of the main pulmonary artery. One other animal, which died during preoperative anesthesia, had previously had a normal (30/7 mm. Hg) pulmonary artery pressure and a normal angiocardiogram. Other control studies are in the process of completion. There appears to be a relationship of fundamental importance between coarctation of the pulmonary artery and pulmonary hypertension.

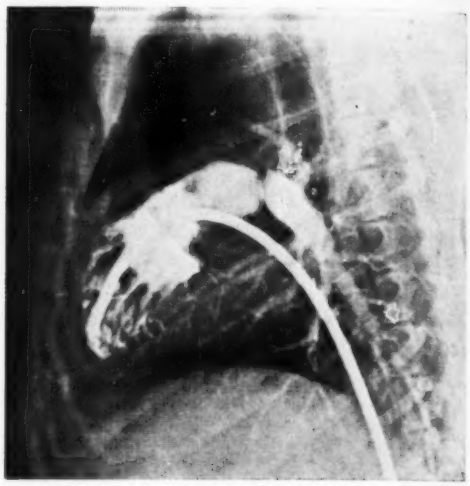

Fig. 2. Angiogram of pulmonary artery of the same dog as in Fig. 1. The constriction of the left pulmonary artery is evident here.

It is now possible to produce pulmonary hypertension by creating a unilateral coarctation in a major pulmonary artery, but not by completely occluding the artery. This is not unlike Goldblatt's hypertension in partially occluded renal arteries. Our studies now are directed at determining the mechanism in these cases. Relationships between degree of constriction and degree of hypertension produced are under consideration, as is the duration of coarctation needed to produce a significant elevation of pulmonary arterial pressure. Since a dual blood supply to the lung is present, there may be an unusual relationship between the flow through the region of the coarctation and the pressure in the right ventricle and pulmonary artery. Flow rates will be determined. Mechanical, neurogenic, and hormonal mediation will be studied. The pathological physiology of pulmonary hypertension can be studied in these animals and pharmacological effects of various drugs can be assayed. This may give a completely new outlook to the problem of pulmonary hypertension.

[1] From the Department of Radiology, University of California School of Medicine, Los Angeles, Calif. This study is supported by a grant of the Los Angeles County Tuberculosis and Health Association.

EDITORIAL

New Concepts in an Old Problem—"Stroke"

One of the most challenging areas of medical investigation today is in the realm of vascular disorders. Many age-old concepts have been disavowed as a result of the employment of newer diagnostic technics now at our disposal. Yielding slowly to concerted efforts are the enigmas of the "stroke syndrome," and embraced within the broad category of rather similar symptom-producing entities are many widely diversified disease processes. They run the gamut from congenital disorders to those peculiar to the aged. No age group is totally free from these disasters; the "stroke," however, most commonly is the result of vascular insufficiency resulting from atherosclerosis in the aging.

The "stroke" or "cerebral accident," has long remained high on the mortality lists of this nation and is destined to become even more prominent as the result of our aging population. It is a calamitous disease when considered either from the economic or social aspect. Also, there are now recognized broad implications as to its importance in relation to threshold areas of noncrippling mental and psychological disturbances.

The statistical bulletin of one of our major life insurance companies recently stated that the National Health Institute of the Public Health Service estimates that at least two million people in the United States are handicapped or incapacitated by cerebral vascular diseases. Furthermore, this publication states that cerebral vascular diseases account for about 185,000 deaths a year in the United States, nearly 12 per cent of the total national mortality. Of this number, almost two-thirds are attributed to cerebral hemorrhage; about one-fourth to thrombosis and embolism. Although these figures are legitimate as regards statistical analysis of death certificates filed in this country, they are totally fallacious in terms of reality. Too many deaths are signed out by the physician as due to cerebral hemorrhage without a specific diagnosis ever having been accomplished. We now are aware of the fact that the larger percentage may be attributable to occlusive arterial disease rather than being associated with a bleeding phenomenon.

Many of the world's outstanding leaders have suffered the ravages of cerebral vascular occlusion. It is noteworthy that all three of the participants in the Yalta Conference were victims of "strokes"; Roosevelt and Stalin sustaining a fatal outcome while Churchill has manifested a remarkable recovery. Of grave concern to the world more recently was the "stroke-like" phenomenon occurring in our Chief Executive. Here again complete recovery seems to have occurred. Louis Pasteur was able to accomplish his best work after a spectacular recovery following a total hemiplegia at the age of forty-six. The vagaries and variations of this syndrome are emphasized by these few examples.

The disease entity is obviously of extreme importance and it has commanded the attention of medical and scientific investigators throughout the centuries. In the past, interpretations of the mechanisms involved in the production of the "stroke syndrome" have been based on studies interpreted strictly from a static or anatomical point of view. Many of the early investigations have led to misconceptions which have unfortunately been handed down without challenge in neurological texts to this day.

Additionally, most studies were confined to observations made of changes within the

confines of the cranial cavity. There has therefore been almost totally lacking any knowledge as to the significance of pathology in the carotid artery in its cervical portion. Discussions of this phase of the problem are almost nonexistent in modern medical texts.

Only in comparatively recent years, with the advent of angiographic technics, have the mechanisms producing the "stroke syndrome" begun to be appreciated. Attention has shifted from the static and anatomic to the physiological character of changes associated with carotico-cerebral and vertebral basilar atherosclerosis. This method of graphic representation of hemodynamics serves well to explain some of the factors responsible for spontaneous improvement in these patients. Further, revelations of angiography have directed many workers into channels of potential medical and surgical therapy for these lesions. Although cerebral angiography was evolved originally for the investigation of possible mass lesions within the cranial cavity, its application in instances of bleeding has long been recognized. During the past several years its importance in evaluating atheromatous disease of cerebral vessels has begun to be appreciated, but not until the area of the bifurcation of the common carotid artery was included in the radiograph was adequate attention directed to the vital area at the origin of the internal carotid. We have now come to recognize the fact that atheromatous changes at this site resemble very strikingly similar changes noted at the origin of the iliac arteries in the Leriche syndrome. We are therefore considering many of the same pathological changes as exist in other instances of peripheral vascular abnormalities.

The potential for collateral flow in the cerebral circulation is significantly greater than in most other areas of the human body. It is interesting to note that this potential was pointed out by Halsted as early as 1905, his aim being "to obtain by gradual occlusions a secondary development of the collateral circulation in parts liable to suffer by insufficient vascular supply." Our present-day knowledge has been enriched by works of many other investigators. Summation of the knowledge as to congenital malformations in the circle of Willis carried out by Padget contributed significantly to the fundamentals essential to understanding cerebral vascular flow patterns. The circle of Willis in its normal state enhances the potentials of collateral flow very remarkably. Although we recognize that there may be congenital abnormalities in the circle in as many as 50 per cent of all persons, there are seldom clinical signs of vascular insufficiency.

The problem of interpreting the findings in relationship to the anterior cerebral artery serves especially to define this question. Congenital defects of the anterior cerebral artery have been shown to occur in 2 per cent of all patients. In the occlusive disease group, 8 per cent of abnormalities are demonstrated in the anterior cerebral artery. We are therefore challenged to an understanding of the 6 per cent difference that we know occurs, since this group alone accounts for 6,000 patients in each 100,000 deaths from cerebral vascular disease.

It seems apparent, therefore, that it is not until superimposed abnormalities of vascular patency and hemodynamics occur that clinically significant evidence of cerebral ischemia may be revealed. The various patterns of neurologic deficit, then, are dependent upon intra-arterial pressure, the degree of patency of carotid and vertebral systems, the circle of Willis, and the availability of collateral circulation.

Many new vistas were opened in the years immediately after the discovery of the potential usefulness of the roentgen ray as a diagnostic agent. The early radiologists for the most part were "converted" clinicians, and their knowledge in clinical medicine aided immeasurably. In more recent years, with the development of higher degrees of specialization, we have seen collaboration between medical specialists of various disciplines develop in an approach to the solution of profound medical problems. In the series of papers appearing elsewhere in this issue of RADIOLOGY

(pp. 801–840), there is a fine demonstration of the efficacy of integrated fundamental and clinical research. Cerebral vascular disease is considered in its several facets on the basis of studies of neuropathological material, physiological and pharmacological experimental work, clinical and radiologic observations, and, finally, therapeutic potentials. The material being presented is based primarily on a critical evaluation of 200 patients studied on the Cerebral Vascular Unit of the Detroit Memorial Hospital by each of the authors, who are members of the staff of the Wayne State University College of Medicine. All of the patients were admitted with a clinical diagnosis of "stroke" or "cerebral accident," and all were evaluated clinically, neurologically, and radiographically by routine and angiographic technics and by electroencephalography and other methods. Significantly integrated into these discussions are results of various laboratory experiments carried out in monkeys and other laboratory animals. Nowhere else in medical literature today is it possible to find a better cross section of our existing knowledge of the "stroke syndrome." These papers are commended for thoughtful reading and appreciation of the fact that avenues are gradually opening to the ultimate benefit of such patient sufferers. Ready diagnosis of immediately operative lesions in itself justifies careful studies on patients so afflicted.

The potentialities of reconstructive vascular surgery in the instance of carotid artery occlusions, either by intimectomy or graft replacement, are apparent. The legitimate role of anticoagulant therapy in minimizing the morphologic changes within the brain in the instance of occlusion is well defined on the basis of experimental observations. This modality of therapy also offers the possibility of prevention of progressive thrombosis following minimal occlusions. Emphasis must also be placed on good rehabilitation through well integrated physical and occupational therapy. Many individuals can be returned to useful lives by this means.

The psychiatric and psychological implications of threshold or frank atherosclerotic vascular occlusions are most intriguing. It would probably be safe to conjecture that more adequate prognosis could be made in the instance of innumerable senescent psychiatric problems by the revelation of frank occlusive disease processes. Only minimal work has been carried out on this phase of a particularly fascinating realm of investigation. The work of evaluation of patients with anterior cerebral artery disease is perhaps the opening wedge in our better understanding of this total psychiatric problem.

It becomes obvious, then, that a group evaluation such as depicted here can be carried out in any hospital of moderate staffing and technical facility. The radiologist is challenged to exert every effort in the direction of influencing better diagnosis and care in this category of patients, who too frequently in the past have been relegated to total and permanent incapacity or premature death.

JAMES E. LOFSTROM, M.D.

IN MEMORIAM

CLARENCE ELTON HUFFORD, M.D.

1893–1958

Dr. Clarence E. Hufford, physician, radiologist, and friend to all who knew him well, passed away suddenly in his automobile on March 25, 1958, having suffered a severe coronary occlusion while driving to the meeting of the American Radium Society at Hollywood Beach, Florida.

Dr. Hufford will always be remembered primarily for his qualities of compassion for his fellow man. He was, in the pure sense of the word, a physician, a comforter of the afflicted, and an able counselor of all who approached him in time of anxiety. Those who attended his funeral services will long

remember the theme of the Rev. Elvin J. Olson of Maumee, Ohio, who compared Dr. Hufford's qualities to those of the physician-apostle Luke, one of the best loved of the Twelve.

It is hardly necessary to enumerate here Dr. Hufford's many accomplishments; it has been little more than two years ago that his biography appeared in this Journal.[1] We may recall, however, his faithful attendance at the annual meetings of our Society, his active cooperation in all its activities, and his profound interest in whatever concerned it. We shall miss his presence and his guidance.

Dr. Hufford received his premedical education at Oberlin College, Oberlin, Ohio, and was granted his degree in medicine by Western Reserve University in 1920. The general practice of medicine occupied his attention from 1921 to 1929. In the latter year he joined Dr. John T. Murphy in the practice of radiology in Toledo, Ohio, and at St. Vincent's Hospital. He assumed the directorship of that hospital's Department of Radiology on the death of Dr. Murphy in 1944.

At the time of his death, Dr. Hufford was Consulting Radiologist at St. Vincent's Hospital and headed a group of practicing radiologists in Toledo, Ohio, who will continue to benefit for many years from the principles which he inculcated in them by his teachings and example.

Dr. Hufford's membership in the Radiological Society of North America dated from 1929. He served on the Board of Directors from 1951 to 1954, and in 1955 became President-Elect. He assumed the Presidency in 1956. In addition to his more than twenty-five years of service and activity in that organization, he was a Chancellor of the American College of Radiology for several years and President of the Ohio Division of the American Cancer Society in 1952–1953. He was a member of the American Roentgen Ray Society, the American Radium Society, the Ohio State Radiological Society, and the Detroit X-ray and Radium Society. The Gold Medal of the American Cancer Society was awarded him in 1955.

Surviving and mourning the death of Dr. Clarence E. Hufford are his wife, Crystal; his daughter, Mrs. Virginia Willard; his three grandchildren; his mother, Mrs. Amaretta Hufford; and a multitude of friends. F. C. CURTZWILER, M.D.

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[1] Radiology **66**: 272, 1956.

BENNET J. McGUIRE, M.D.

1896–1958

Dr. Bennet J. McGuire of Pittston, Penna., died on Feb. 18, 1958, in the Veterans Hospital, Wilkes-Barre, where he had been a patient for several months.

Dr. McGuire was born in Jenkins Township, Pennsylvania, in 1896. He attended the Pittston High School and subsequently was employed as an Indian Agent with headquarters in Leech Lake, Minnesota. In 1919 he entered the University of Pittsburgh Medical School, from which he was graduated in 1925. After serving his internship in the U. S. Army Hospital in San Antonio, Texas, he returned to Pittston to engage first in general practice and later to specialize in radiology. He was a member of the Pennsylvania Radiological Society, of which he was at one time vice-president, a member of the Radiological Society of North America, of the International Congress of Radiology, the National Rehabilitation League, and the Upper Luzerne Tuberculosis Association.

Dr. McGuire was an enthusiastic sportsman. He was active also in numerous civic, charitable, and religious (Roman Catholic) undertakings. His deepest interest was perhaps in the Kis-Lyn Industrial School for Boys. He was a member of its Board of Directors and for several years served as vice-president.

Dr. McGuire is survived by his wife, the former Bernice Doverspike, by a son, Dr. John McGuire and a daughter, Elizabeth.

ERVIN F. LYON, JR., M.D.

1908–1958

Dr. Ervin F. Lyon, Jr., of San Antonio, Texas, died on Jan. 2, 1958, of a cerebral hemorrhage. Dr. Lyon was born in 1908, the son of Mary Eleanor Perkins and Ervin F. Lyon, D.D. He was graduated from Baylor University and Baylor University College of Medicine, receiving his M.D. in 1931. After serving his internship in Grace Hospital, Detroit, he went to the University Hospital, Baltimore, for his residency. The remainder of his life was spent in practice in San Antonio, except for five years service in the Air Force Medical Corps in World War II, first as captain and then as major.

Dr. Lyon was a member of the Texas Radiological Society and at one time its president, a member of the Rocky Mountain Radiological Society and of the Radiological Society of North America, a fellow of the American College of Radiology, and a diplomate of the American Board of Radiology. He is survived by his wife, the former Betty Fiser, two daughters, and a son.

MIDSUMMER CONFERENCE ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The twentieth Midsummer Radiological Conference of the Rocky Mountain Radiological Society will be held Aug. 14–16, 1958, at the Shirley Savoy Hotel, Denver, Colo. Guest speakers expected to take part in the meeting are Dr. Ellwood W. Godfrey, Princeton, N. J.; Dr. Vincent P. Collins, Houston, Texas; Dr. John Caffey, New York, N. Y.; Dr. Henry D. Diamond, New York, N Y.; and Dr. L. Henry Garland, San Francisco, Calif. Others participating in the program will be Angus K. Wilson, M.D., Salt Lake City, Utah; Leo G. Rigler, M.D., Los Angeles, Calif.; Wendell G. Scott, M.D., St. Louis, Mo.; Vincent W. Archer, M.D., Charlottesville, Va.; James W. Lewis, M.D., Colorado Springs, Colo.; Clare C. Wiley, M.D., Longmont, Colo.; James M. Perkins, M.D., Denver, Colo.; B. Kazan, RCA Laboratories, Princeton, N. J.; Gwilym S. Lodwick, M.D., Columbia, Mo.; Mr. Robert Morrison, Eastman Kodak Company, Rochester, N. Y.; Gerald S. Maresh, M.D., Denver, Colo.; E. Dale Trout, Ph.D., General Electric X-Ray Company, Milwaukee, Wisc.; Arnold Feldman, M.S., Dimitry Morkovin, M.D., John S. Bouslog, M.D., and Raymond R. Lanier, M.D., Denver, Colo. A wide variety of subjects of radiological interest will be discussed, and the concluding session on Saturday morning will be a two-hour period of roentgen film diagnoses.

Special features will include a trip to Central City, with dinner at the Teller House, followed by an opportunity to attend a play at the Central City Opera House.

SEVENTH CONFERENCE ON HOT LABORATORIES AND EQUIPMENT

Abstracts for papers to be presented at the Seventh Conference on Hot Laboratories and Equipment to be held in Cleveland, Ohio, in April 1959, are due Sept. 15, 1958, and should be sent to the program chairman: L. G. Stang, Jr., Brookhaven National Laboratory, Upton, N. Y. The deadline for papers will be announced later. Contributions are invited on all phases of hot laboratories and equipment for handling radioactive material, including design, construction, operation, maintenance, decontamination, remodelling, shielding calculations, costs, etc.

SOCIEDAD MEXICANA DE RADIOLOGÍA

The Sociedad Mexicana de Radiología announces the following executive board for the year 1958–1959: President, Dr. Manuel Morales Duclaud; Secretary-General, Dr. Jorge Ceballos Labat; Treasurer, Dr. Baudelio Villanueva; Secretary of the Minutes, Dr. Paul Loewe.

The Society has recently acquired its own building at Calle de Coahuila, Núm. 35, Mexico 7, D. F., and extends a cordial invitation to radiologists to visit its headquarters.

SOCIEDAD VENEZOLANA DE RADIOLOGÍA

The Sociedad Venezolana de Radiología has recently elected a new administrative council as follows: President, Dr. Theoscar Sanoja; Vice-President, Dr. Cesar Herrer Pinto; Secretary-General, Dr. Sebastian Nuñez Mier y Teran, Apartado 9362, Caracas, Venezuela, S. A.; Recording Secretary, Dr. Diego Nuñez Campos; Treasurer, Dr. Ruben Merenfeld; First Director, Dr. Miguel Dao; Second Director, Dr. Rafael Millan.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

THE MEDICAL MANAGEMENT OF CANCER. By HENRY D. DIAMOND, M.D., F.A.C.P., Associate Attending Physician, The Medical Neoplasia Service of the Department of Medicine, The Memorial Center for Cancer and Allied Diseases; Associate, and Section Head of the Lymphoma Section of the Division of Clinical Chemotherapy, The Sloan-Kettering Institute for Cancer Research; Assistant Professor of Clinical Medicine, Cornell University Medical College, New York, N.Y. A volume of 180 pages, with 41 figures, including 1 colored plate, and 23 tables. Published by Grune & Stratton, Inc., New York, N. Y., 1958. Price $6.75.

ATOMIC ENERGY IN MEDICINE. By K. E. HALNAN. The Atoms for Peace Series. General Editor: D. Wragge Morley. A volume of 158 pages, with 31 figures and 11 tables. Published by The Philosophical Library, New York 16, N. Y., 1957. Price $6.00.

THE ATOMIC AGE AND OUR BIOLOGICAL FUTURE. By H. V. BRØNDSTED. Translated by E. M. Huggard. A volume of 80 pages. Published by The Philosophical Library, New York 16, N. Y., 1957. Price $4.75.

OUR NUCLEAR ADVENTURE: ITS POSSIBILITIES AND PERILS. By D. G. ARNOTT. A volume of 170 pages, with 17 figures and many tables. Published by The Philosophical Library, New York 16, N. Y., 1958. Price $6.00.

TRAUMATISMES ANCIENS: GÉNÉRALITÉS; MEMBRE SUPÉRIEUR. By R. MERLE D'AUBIGNÉ, Professeur de Clinique chirurgicale orthopédique et réparatrice à la Faculté de Médecine de Paris, and R. TUBIANA, Ancien Chef de Clinique chirurgicale à la Faculté de Médecine de Paris. With the collaboration of P. Boutin, L. Faulong, G. Lord, P. Masse, P. Maurer, M. Postel, J.-O. Ramadier, and O. Troisier. A volume of 440 pages, with 215 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6e, France, 1958. Price 5,900 francs; paper bound 5,000 francs.

ÉTUDE RADIOLOGIQUE DE LA CIRCULATION VEINEUSE DU MEMBRE SUPÉRIEUR (SUJET NORMAL). By ERCOLE LAVIZZARI AND VALERIO OTTOLINI. Prefaces by MM. les Pres R. Fontaine and F. Perussia. Adaptation and translation from Italian by J. Bories and D. Dilenge. A monograph of 122 pages, with 38 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6e, France, 1958. Price, paper bound, 2,400 francs.

PSEUDARTHROSE CONGÉNITALE DU TIBIA ET SON TRAITEMENT. By M. GUILLEMINET and R. RICARD. A monograph of 98 pages, with 78 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6e, France, 1958. Price, paper bound, 1,800 francs.

RADIOTERAPIA MODERNA. By F. WACHSMANN, G. BARTH, AND S. DI RIENZO. A volume of 314 pages, with 129 figures and 6 tables. Published by Editorial Assandri, Dean Funes 61, Córdoba, Argentina, 1957.

Book Reviews

ANGIOCARDIOGRAPHIC INTERPRETATION IN CONGENITAL HEART DISEASE. By HERBERT L. ABRAMS, M.D., Assistant Professor of Radiology, Stanford University School of Medicine, San Francisco, California, and HENRY S. KAPLAN, M.D., Professor of Radiology, Stanford University School of Medicine. Publication Number 279, American Lecture Series, a monograph in the Bannerstone Division of American Lectures in Pediatrics. A volume of 234 pages, with 163 figures. Published by Charles C Thomas, Springfield, Ill., 1956. Price $11.75.

This work is intended, according to the Preface, for all physicians interested in the diagnostic evaluation of congenital cardiovascular anomalies. Because most such anomalies are encountered in infancy and childhood, it is concerned largely with this early age group. It offers a concise presentation of its subject, summarizing current knowledge on the basis of the experience of the authors and others.

Section I opens with an account of the history and development of angiocardiography and considers in adequate detail all factors important in the execution of the procedure. The indications and contraindications, choice of positions, site of injection, pre-and post-examination care of the patient, and complications are discussed. A chapter on contrast materials and reactions is useful, although some of the newer agents, such as Hypaque and Miokon, are not included. Effects on the different organ systems are taken up, as are the factors implicated in angiocardiographic fatalities. Sensitivity tests are considered and a dosage schedule is suggested.

The chapter on general principles of angiocardiographic interpretation is perhaps the most informative in the book. There is an excellent analysis of the normal angiocardiogram, stressing such fundamental conceptions as sequence of opacification and anatomical relationship of the individual chambers. A similar analysis of the abnormal follows, including presence, absence, or change in opacification sequence, abnormal chamber and vessel size, abnormal position and contours, and rate of flow and emptying time. A separate chapter is devoted to aortography.

Section II includes a chapter on each of the more usual congenital anomalies of the heart and great vessels, while the rare malformations are treated more briefly in a final chapter. Under each heading there is a discussion of anatomical and physiologic alterations associated with the malformation in question, as well as the clinical, electrocardiographic, plain film, and catheterization manifestations. The role of angiocardiography and its indications in each anomaly are considered in detail. Angiocardiographic findings are fully described, with careful analyses of each of the chamber and great vessel alterations. The diagnostic, surgical, and prognostic importance of various findings is indicated and differential diagnosis is discussed.

Completing the book is an appendix, tabulating the differential diagnoses of the common anomalies, summarizing information that can be obtained from clinical examination, electrocardiography, conventional films, angiocardiography, and catheterization. An exceptionally complete, relevant, up-to-date bibliography is found at the end of each chapter. Large numbers of excellent reproductions and diagrams illustrate every major discussion.

In general, this book is a significant contribution to the field of angiocardiographic interpretation. It is the most concise yet reasonably complete single work on the subject that this reviewer has encountered. Students and practitioners of cardiology, pediatrics, and cardiac surgery, as well as of radiology, will find much of benefit in its pages.

THE POSTOPERATIVE CHEST: RADIOGRAPHIC CONSIDERATIONS AFTER THORACIC SURGERY. By HIRAM T. LANGSTON, M.D., ANTON M. PANTONE, M.D., MYRON MELAMED, M.D. Publication Number II, The John Alexander Monograph Series on Various Phases of Thoracic Surgery. A monograph of 228 pages, with 190 roentgenograms with accompanying diagrams. Published by Charles C Thomas, Springfield, Ill., 1958. Price $8.00.

This monograph is the second of a series on Various Phases of Thoracic Surgery bearing the name of John Alexander, former Professor of Surgery in the University of Michigan, in whose memory it has been planned. The present volume is devoted to the roentgenographic study of the postoperative chest which has assumed increasing importance in recent years because of the tremendous strides made in thoracic surgery.

The authors have analyzed the results of their studies of over 300 suitable cases, classifying the roentgen appearances under the following main headings: Soft Tissues, Foreign Bodies, Ribs, Diaphragm, Mediastinum, Pleural Cavity, Lungs, and Complications.

The material is presented in the form of an atlas of 80 illustrative cases. Each roentgenogram has an accompanying line drawing and an explanatory legend which is adequate for its purpose. The authors state that their experience leads them to recommend "high kilovoltage" technic for more uniform radiographs and a better demonstration of lesions.

This monograph will be helpful to those who are interested in chest diseases, and especially to those who are members of teams engaged in the surgery and aftercare of such cases.

THE LOWER URINARY TRACT IN CHILDHOOD: SOME CORRELATED CLINICAL AND ROENTGENOLOGICAL OBSERVATIONS. By SVEN ROLAND KJELLBERG, NILS OLOF ERICSSON, AND ULF RUDHE. Translated from the Swedish by Erica Odelberg. A volume of 298 pages, with 265 figures, mostly roentgenograms. Published by The Year Book Publishers, Inc., Chicago, Ill., 1957. Price $18.00.

The material in this book is based on studies of 1,155 cases of lower urinary tract disorder seen at the Pediatric Clinic of Karolinska Sjukhuset, Stockholm, between January 1952 and April 1956. It is a combined study by a urologist and two radiologists.

Introductory chapters, devoted to the embryology, anatomy, and physiology of the lower urinary tract, furnish a background for the subsequent clinical and roentgen observations. The main body of the text is devoted to detailed studies on the various lesions of this region. The clinical aspects are stressed in most instances, so that the problem is clearly outlined for the reader. This is followed by descriptions of the various methods of examination available to the clinician. The roentgen examination is stressed throughout, and numerous well chosen roentgenograms are reproduced. These are of great value in supplementing the text. They are well reproduced in the negative phase and show good detail. An extensive bibliography follows the text.

This is an excellent discussion of a subject that is of great interest to the urologist, radiologist, and pediatrician.

THE MEASUREMENT OF BODY RADIOACTIVITY. British Journal of Radiology Supplement No. 7. Papers Read at a Conference held at Leeds, April 16–17, 1956. Editor: C. B. ALLSOPP. With a foreword by Professor F. W. Spiers, D.Sc. A volume of 130 pages with numerous illustrations and tables. Published by the British Institute of Radiology, London, England, 1957. Price 25s.

The *British Journal of Radiology* has published as a Supplement a compilation of papers devoted to the natural radioactivity of the body, read at a conference held at Leeds on April 16–17, 1956.

The measurement of the radioactivity of the human body becomes of greater importance as the danger of inhalation or ingestion of radioactive material rises. The first six papers published here describe the use of high-pressure ionization chambers and scintillation counters for such measurements, and the last three its assessment by excretion methods. The natural occurrence of radium is the subject of two papers, and figures are given for its concentration in water in many cities of the United States. An investigation of the radioactivity of a radium worker, who died of leukemia, is reported.

ANNUAL REVIEW OF NUCLEAR SCIENCE. VOLUME 7. Editor: JAMES G. BECKERLEY, Schlumberger Well Surveying Corporation. Associate Editors: ROBERT HOFSTADTER AND LEONARD I. SCHIFF, both of Stanford University. A volume of 496 pages, with charts and figures. Published by Annual Reviews, Inc., in co-operation with the National Research Council of the National Academy of Sciences, 1957. On sale by Annual Reviews, Inc., Palo Alto, Calif. Price $7.00, U. S. A.; $7.50 elsewhere.

The Seventh Annual Review of Nuclear Science is devoted in large part to pure physics, particularly meson physics, and will probably not be of great interest to those whose work is concerned with the clinical applications of radiation. The chapters on radiobiology, however, are pertinent. That on Cellular Radiobiology, by E. L. Powers of the Argonne National Laboratory, discusses the site of action of radiation in the cell and the various factors influencing its effectiveness. "Biochemical Effects of Ionizing Radiation" by Barbara Holmes takes up the effect of whole-body irradiation on fat and carbohydrate metabolism, tissue proteins, and hemoglobin formation. The discussion of oxygen effect and

protection against and recovery from irradiation should be of particular interest at this time. The two chapters on vertebrate radiobiology, by V. P. Bond and J. S. Robertson of the Brookhaven Laboratory and C. C. Lushbaugh of Los Alamos, give the LD 50 for various biological materials and discuss factors which change these figures, including post-treatment factors. The pathology of radiation injury is discussed in detail for various tissues, including skin, capillaries, gastrointestinal tract, liver, pancreas, endocrine glands, etc.

THE BIOLOGIC BASIS OF CANCER MANAGEMENT. By FREDDY HOMBURGER, M.D., Research Professor of Medicine, Tufts University School of Medicine; Scientific Associate, Roscoe B. Jackson Memorial Laboratory. Forewords by Lauren V. Ackerman, M.D., Clarence Cook Little, Sc.D., Alton Ochsner, M.D. A volume of 354 pages, with 10 figures and 39 tables. Published by Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York, N. Y., 1957. Price $10.00.

The author of this book relating the biology of cancer to its treatment is both a cancer investigator and an internist, which has enabled him to succeed remarkably well in integrating information from various fields in the study of cancer. Such information is usually so scattered throughout the literature that it is a time-consuming job to find it. Dr. Homburger has woven the point of view of the pathologist, the biologist, and the clinician into a complete picture of the whole disease—etiology, biologic behavior, diagnosis, treatment, and prevention. Animal experiments are described side by side with clinical studies.

An extensive bibliography, comprising about a fifth of the book, offers the reader opportunity to pursue any phase of the subject which he finds of partiular interest.

L'ARTHROGRAPHIE OPAQUE DU GENOU: CONTRIBUTION AU DIAGNOSTIC DES DÉRANGEMENTS INTERNES DU GENOU. By PAUL FICAT, Assistant de Chirurgie des Hôpitaux, Diplômé d'Électro-Radiologie. Preface by P^r R. Merle D'Aubigné. A volume of 244 pages, with 139 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6^e, France, 1957. Price 3,800 francs.

This monograph is a thorough presentation of arthrography of the knee. After a concise history of the procedure, pertinent anatomic and technical details are described, and congenital, traumatic, and degenerative internal derangements of the knee are discussed. Excellent roentgenograms of the normal and abnormal are reproduced, with sketches to aid interpretation.

Arthrography is of assistance in delineating the anatomic features of questionable changes in the menisci and is the most precise method of examining the posterior cornua.

LITHIASE DE LA VOIE BILIAIRE PRINCIPALE. By PABLO-L. MIRIZZI, Professeur a l'Université de Córdoba, Argentina. A monograph of 162 pages, with 79 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6^e, France, 1957. Price 2,200 francs.

This monograph is concerned largely with surgical procedures and principles involved in lithiasis of the bile ducts. Pertinent anatomic and physiologic data precede the discussion on surgical tactics. Of interest to radiologists are the numerous reproductions of cholangiograms, with sketches to elucidate the roentgenographic features. The value of operative cholangiography is stressed throughout.

ANGIOGRAPHIE DER NIEREN. By ERICH VOGLER, Univ.-Dozent Dr. Med. Univ. (Zentral-Röntgen- und Radiuminstitut des Landeskrankenhauses Graz. Vorstand: Hofrat Univ.-Prof. Dr. Med. Univ. Anton Leb), and RUDOLF HERBST, a.o. Univ.-Prof. Dr. Med. Univ. (Vorstand der urologischen Abteilung des Landeskrankenhauses Graz). With a Foreword by Hofrat Univ.-Prof. Dr. Med. Univ. Anton Leb, Graz. Fortschr. a.d. Geb. d. Röntgenstrahlen, Ergänzungsband 81. A volume of 112 pages with 182 figures, including 141 roentgenograms. Published by Georg Thieme Verlag, Herdweg 63, Stuttgart 14a, Germany, 1958. Distributed in the United States and Canada by Intercontinental Medical Book Corporation, New York, N. Y. Price DM 54.—($12.85).

This small but exhaustive monograph deals with all phases of angiography of the kidney. The first part treats of fundamental and general considerations, such as indications, equipment, preparation of the patient, the various technics (intravenous, translumbar, catheterization, and "aimed" angiography), scope and limitations of the method, and reactions.

The second part deals with the specific diseases, following a discussion of the normal angiographic anatomy. Chapters are included on anomalies, disturbances of circulation, infections (tuberculous and nontuberculous), cysts, benign and malignant tumors, hydronephrosis, pheochromocytoma, and the unilateral "functionless" kidney. The differential value of angiography in retroperitoneal tumors is also illustrated.

The text is profusely illustrated with beautifully reproduced roentgenograms showing the many conditions under discussion. The bibliography is extensive, covering contributions from Germany and abroad. Finally the physical make-up of the volume is excellent. It can be recommended to all interested in this diagnostic method.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Pathologic-Anatomical Findings at the Puncture Site in Cerebral Arteriography and a Discussion of the Puncture Technic. A. Rimpau and H. Seils. Fortschr. a. d. Geb. d. Röntgenstrahlen **87:** 191–199, August 1957. (In German) (H. S., Allgemeine Krankenhaus, Hamburg-Rissen, Germany)

This paper consists of two parts. The first, by Rimpau, is concerned with the pathologic aspects of the puncture site in 200 cases in which percutaneous carotid arteriography had been done. In almost all recent cases minimal hemorrhage into the vessel sheath and surrounding musculature was observed. Larger hematomas, seen in 8 per cent of this series, are usually attributable to puncture of the adjacent jugular vein. In most of the cases the imprint of the needle point was apparent on the vessel wall opposite the puncture site. In one case, intramural injection resulted in the formation of a dissecting aneurysm involving the entire common carotid artery. It was noted that complications were more frequent following injection of the internal carotid than of the common carotid artery.

In the second part of this contribution, Seils views the possible hazards of cerebral arteriography from the standpoint of the clinician. While complications due to percutaneous puncture are rare, the possibility must be taken into consideration when delayed neurologic symptoms become manifest. In any event, a meticulous technic is indicated. For the puncture, the author uses a needle with a short, sharp point. After the skin is pierced, the needle is brought to the point of maximum pulsation and the artery is entered by a sudden quick maneuver, or pressure on the needle is increased gradually until blood flows into the attached syringe. To make sure that the needle is in the lumen of the vessel and has not pierced the wall, a saline solution is injected before introduction of the medium itself. Free return of blood after the test injection indicates proper placement of the needle. For details of the procedure the original paper should be consulted.

Three roentgenograms; 3 photomicrographs; 2 drawings.

Cysticercosis of the Brain. C. Arseni and D. C. Samitca. Brit. M. J. **2:** 494–497, Aug. 31, 1957. (C. A., Postgraduate Institute of Medicine, Bucharest, Rumania)

The authors report 65 cases of cysticercosis of the brain, 37 in males and 28 in females. Twenty-three of the patients were under the age of thirty. Cysticerci are usually found in a single organ and 90 per cent of the authors' cases were limited to the brain. The duration of symptoms prior to hospital admission varied from a few weeks to several years. Symptoms depend both on the number of parasites and on their precise location within the brain. In the initial stage there are signs of severe intracranial hypertension, epilepsy, and a pseudomeningeal reaction.

Various neurological syndromes may occur, again depending on the degree and site of infestation. Cysticerci may float freely in the ventricular fluid and produce symptoms suggestive of intraventricular tumors. Ten patients in the present study had ventricular cysticercosis. At the base of the brain cysticerci are usually numerous and large in size and may block the basal cisterns and cause severe internal hydrocephalus.

Blood studies show an elevated eosinophilic count, and cerebrospinal fluid eosinophilia may occur, with lymphocytosis, a high albumin content, and a colloidal-gold curve similar to that of syphilis.

Plain skull films may be normal or there may be evidence of intracranial hypertension and a number of round, discrete areas of calcification may be seen, each the size of a millet grain, distributed either haphazardly or in lines. Plain radiographs of the skull disclosed no abnormality in 40 of the authors' 65 cases. Intracranial calcification was seen in 7, and signs of increased intracranial pressure in 18.

Pneumoencephalography may be performed if there is no papilledema. This usually shows no abnormality but there may be severe hydrocephalus from basal leptomeningitis or signs of cortical atrophy. In early cases without marked leptomeningitis it may be possible to demonstrate Filipov's sign of the "clear vesicle"—a spherical or ovoid area, the size of a lentil or a bean, with a very clear center, darker toward the edges, and with a sharply defined outline.

Ventriculography shows a variable picture. Hydrocephalus with dilatation of the third ventricle may be noted with involvement of the posterior fossa, or hydrocephalus with an upward displacement of the third ventricle if parasites have invaded the base of the brain. Ventriculography was carried out in 35 patients and in 32 a symmetrical internal hydrocephalus was found.

A positive diagnosis can be made upon such pathognomonic signs as intracranial calcifications, the pneumoencephalographic sign of Filipov, and the specific serologic precipitation test of Vosnia. A history of *Taenia solium* infestation and the presence of cysticerci in other parts of the body, as the retina and skeletal muscles, may add credence to the diagnosis. The prognosis is poor in generalized, basal, or ventricular cysticercosis. Patients die as a result of raised intracranial pressure or ventricular block. Cortical cysticercosis runs a more chronic course.

Five roentgenograms; 4 photographs; 1 drawing.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Diagnosis of Free Fluid Within the Paranasal Sinuses. M. Glass. South African M. J. **31:** 876–880, Aug. 31, 1957. (Cape Town, Union of South Africa)

It is customary to diagnose "free" fluid radiologically within the paranasal sinuses according to the rule that all fluid levels are horizontal and remain so whichever way the head is tilted in the erect position. The author states that this concept of "invariant horizontality" is out of accord with anatomy, pathology, and physical laws. He believes that fluid-level behavior cannot be predetermined within the morphologically unpredictable and pathologically variable paranasal sinuses. Sinus space is not a fixed, uniform, standardized, immutable entity.

Cases are presented to show that the customary partial tilt for verification of free fluid in the sinuses can be misleading. A complete right-angle tilt is suggested as a more exacting test of the characteristic of "freeness" and the "physical composition of shadow."

Twenty-four roentgenograms.

THE CHEST

The Combination of Trichloroethylene General Anaesthesia with Surface Anaesthesia for the Purpose of Bronchography. W. H. J. Cole. M. J. Australia **2**: 324–325, Aug. 31, 1957.

A technic is described for the performance of bronchographic examinations in young children and non-co-operative older patients. Preparatory procedures are those usually utilized. General anesthesia is induced with a small intravenous dose of a barbiturate followed by inhalation of ethyl chloride or trichloroethylene until the patient is in light Stage III anesthesia. After satisfactory general anesthesia has been obtained, a laryngoscopic examination is performed, and the trachea and larynx are sprayed with a 1/2 per cent solution of amethocaine with Neo-Synephrine. Next, a fine rubber catheter is passed through the nose and guided into the trachea and a pharyngeal airway is placed in the mouth and connected to the anesthetic machine. In this manner trichloroethylene vapor and oxygen can be administered to the patient, as needed, throughout the procedure. Surface anesthesia of the bronchi is obtained by instillation of 1 c.c. of the amethocaine solution through the indwelling catheter. After a short delay, followed by aspiration through the catheter if necessary, the radiopaque oil is injected under direction of the radiologist. Apparently fluoroscopy is not performed. Films are made as indicated and in the positions chosen. When satisfactory films have been obtained, as much of the oil as possible is aspirated and the patient is placed in a dependent position to favor drainage.

The author believes that all procedures involving the larynx and tracheobronchial tree with the patient under general anesthesia still require effective surface anesthesia for satisfactory contrast studies. It is noted that the procedure is a major undertaking and should not be utilized without clearcut clinical indications.

JAMES W. BARBER, M.D.
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Bronchiectasis. Radiological Diagnosis and Prognosis After Operative Treatment. Carl Einer Gudbjerg. Acta radiol., supp. 143, 1957, pp. 1–118. (Department of Radiology, Rigshospitalet, Copenhagen, Denmark)

In this monograph, some 28 pages are devoted to a summary of the literature on bronchiectasis, with a review of the author's earlier contributions to the subject (see, for example, Absts. in Radiology **65**: 628, 1955; **66**: 128, 1956), especially as concerns diagnosis by plain films and bronchography. The investigation reported here has to do with diagnosis and prognosis as determined by postoperative bronchography.

Of 112 patients, 92.9 per cent exhibited changes on plain chest films including increased lung markings, honeycomb structure, and lobar atelectasis. In spite of this high incidence of demonstrable abnormalities, the author states emphatically that "a completely normal plain chest film does not rule out the diagnosis, which can be established with certainty only by bronchography." As most of the patients in this series gave a prolonged clinical history, the changes described are regarded as representing mainly advanced disease.

For assessment of the prognosis following operative intervention, 86 cases are considered. Five main groups are represented as follows:

Unilateral bronchiectasis
(1) Unilateral lobectomy and/or unilateral segmental resection (52 cases)
(2) Unilateral pneumonectomy (12 patients)
Bilateral bronchiectasis
(3) Unilateral lobectomy and/or unilateral segmental resection (12 cases)
(4) Unilateral pneumonectomy (1 case)
(5) Bilateral lobectomy and/or segmental resection (7 cases)

A sixth group of 7 patients were treated by the tourniquet method, which has since been abandoned.

Lobectomy was found to be preferable to segmental resection, at least from the radiological point of view. Prognosis is better following right than left lobectomy, and the findings indicate that in left lower lobectomy the results are better if the lingula is removed as well, even in the absence of demonstrable lesions in this segment.

Although a curative effect may be obtained in patients of the older age groups, operation is indicated first and foremost in unilateral bronchiectasis affecting patients under thirty years of age.

Bronchography cannot be used as the sole factor in assessing the value of operative treatment, especially in bilateral disease. In bilateral cases it is not always possible to remove all the affected segments if a satisfactory pulmonary function is to be preserved. In such instances, therefore, clinical examination, comparing the intensity of the symptoms and the patient's general state of health and working capacity before and after the operation will better reflect the therapeutic effect.

An excellent description is given of the postoperative torsion of the remaining bronchi, and the part this may play in the development of further disease processes.

Detailed reports of the 86 cases evaluated in the study are included. Reproductions of bronchograms demonstrate the bronchial stumps and torsion of the remaining bronchi.

Forty-five roentgenograms.

J. E. RHODENBAUGH, M.D.
The Henry Ford Hospital

Experiences with Bronchography in the Management of Pulmonary Tuberculosis. S. E. Copp, T. K. Krzyski, and S. J. Shane. Canad. M. A. J. **76**: 947–951, June 1, 1957. (S.E.C., Cedarcrest, Newington, Conn.)

Since the presence of bronchiectasis is one of the indications for surgery in pulmonary tuberculosis, its recognition is obviously of the utmost importance in the management of the latter disease. An analysis is given of 602 bronchographic studies on 400 consecutive patients, in whom 738 lungs were examined. Bronchography was performed on all patients with pulmonary tuberculosis with residual disease demonstrable on a chest roentgenogram or planigrams when the patient had reached the point at which no further benefit could be expected from medical treatment. It was also carried out, when indicated, in all patients referred for investigation of undiagnosed pulmonary disease without evidence of active tuberculosis. Its value as a presurgical measure in pulmonary tuberculosis is attested by the finding of an overall incidence of bronchiectasis of 43 per cent of the series.

The authors believe that, with the technic which they

describe, bronchography can be readily performed on almost any patient. Fluoroscopy is not employed as a guide in depositing the contrast medium; the relatively blind method has resulted in consistently satisfactory bronchograms. The authors have found that when they are unable to fill a particular lobe or segment, it is seldom possible to do so at a subsequent examination.

Dionosil Oily has proved to be the most satisfactory bronchographic agent to date. The amount of medium used was larger than that recommended by the manufacturer (20 to 30 c.c. per lung, depending on the size of the patient). No severe reactions occurred, but minor reactions of two types were encountered. Twenty-one patients had a temperature elevation to 100° F. or over following bilateral and 9 following unilateral bronchography. Two patients had skin eruptions.

In the authors' experience, when bronchography of both lungs is necessary, it is more satisfactory to the patient and the physician to perform a single bilateral bronchographic examination than two separate studies. Although the procedure is accompanied by a large number of febrile reactions, many patients have indicated that they would prefer to undergo a few hours of pyrexia than submit to the discomfort of two separate bronchographic studies.

Four roentgenograms; 3 tables.

Coexistent Pulmonary Tuberculosis and Malignancy. Albert Jackson, Pauline E. Garber, and George W. Post. Dis. of Chest **32:** 189–197, August 1957. (VA Center, Wadsworth, Kans.)

Several hundred cases of coexistent pulmonary tuberculosis and cancer have been reported. Some authors consider the coexistence coincidental. However, a debilitating disease such as carcinoma or Hodgkin's disease could activate a smoldering tuberculous infection. On the other hand, altered circulation and bronchostenosis due to tumor might activate a preexisting tuberculosis. Also it has been found that many old tuberculous foci contain crystals of cholesterol, a carcinogen. Saccular bronchiectasis, frequent in tuberculosis, seems to favor localization of tars from smoking.

The authors report 4 cases of pulmonary tuberculosis, of which 2 were associated with Hodgkin's disease and 2 with bronchogenic carcinoma. In none of these cases was the superimposed malignant disease suspected from the chest roentgenogram. The diagnosis was made postmortem.

Diagnosis of coexistent tuberculosis and a malignant process is difficult, due to the similarity of signs and symptoms. Findings suggesting bronchogenic carcinoma are bloody sputum (rather than copious hemoptysis), paroxysmal dyspnea out of proportion to the roentgen findings, progression of roentgen changes while sputum positive for tuberculosis becomes negative, a dense prominent opacity near the hilus, a thick-walled cavity with a ragged lining, diaphragmatic paralysis, retraction of ribs on the affected side, and hypertrophic pulmonary osteoarthropathy. When suspicion is aroused, further procedures, such as cytological study, bronchoscopy, and biopsy, are indicated.

CAPT. GARTH R. DREWRY
MacDill AFB, Fla.

Contribution to the Diagnosis of Carcinoma of the Bronchus. F. Meloni. Schweiz. med. Wchnschr. **87:** 1072–1079, Aug. 17, 1957. (In German) (Zurich National Sanatorium, Davos-Platz, Switzerland)

The author refers to European and American statistics on bronchial carcinoma and urges early diagnosis as well as prophylactic measures, especially as to the use of cigarettes. He suggests greater education of the public as to the possible dangers of tobacco and the value of chest films at six-month intervals for persons above forty years of age.

Eighteen patients are cited, who were erroneously referred to a sanitarium with a diagnosis of tuberculosis. Fifteen of the patients had primary bronchogenic carcinoma; 1 had a metastasis from a seminoma, 1 an adenoma of the bronchus, and 1 a mesothelioma. Symptoms had been present in these patients for three days to three years, average three months. An additional four to five months (average) were lost between the first visit to a physician and the final diagnosis. Four patients had tuberculosis in addition to bronchogenic carcinoma.

In early cases, the roentgen findings may be misleading, such as tuberculoma with cavity, segmental atelectasis, enlarged hilus, pleural effusion, unilateral combined shadows of tuberculosis and carcinoma. In the presence of persistent x-ray findings, bronchoscopy, bronchography and especially cytological studies are urged. Bronchography is sometimes helpful in the recognition of peripheral neoplasms when bronchoscopy has failed. Cytological studies of bronchial secretions, obtained through the bronchoscope, have been reported positive for carcinoma in 70 per cent of the cases or more.

In the series reported, bronchoscopy alone was positive in only 3 cases, but cytological studies were positive in 13 of 16 patients; bronchograms were positive in 12. With persistent x-ray findings and suspicion of tumor, the author strongly urges repeated cytological studies at frequent intervals.

Sixteen schematic drawings; 9 photomicrographs.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

The Diagnostic Value of the Lordosis Projection (Kreuzhohstellung) in the Evaluation of Middle Lobe Atelectasis. Hideo Irie and Keiichi Matsuura. Dis. of Chest **32:** 183–188, August 1957. (Institute of Radiology, Kyushu University, Fukuoka, Japan)

The authors reaffirm the value of Fleischner's lordotic projection in the diagnosis of middle lobe atelectasis (see Fleischner: Ergebnisse der medizinischen Strahlenforschung, edited by Holfelder, *et al.*, Vol. II, 1926, p. 199). They observed 88 postero-anterior chest films with an area of increased density in the right lower lung field adjacent to the heart. In 44 of these cases, antero-posterior lordotic views with the beam parallel to the major interlobar fissure were made. In 19 of these, a triangular shadow with the base along the heart border and the apex pointing toward the lateral chest wall was seen, and in all this was later proved to be due to right middle lobe atelectasis. As originally described by Fleischner, this appearance can also—though less frequently—be due to mediastino-interlobar pleurisy. Bronchography may be necessary to make the distinction in some cases.

Six roentgenograms; 2 drawings.

CAPT. GARTH R. DREWRY
MacDill AFB, Fla.

The Treatment of Ventilatory Insufficiency by Tracheostomy and Artificial Ventilation. A Study of 61 Thoracic Surgical Cases. Viking Olov Björk and Carl-Gunnar Engström. J. Thoracic Surg. **34:** 228–241, August 1957. (Stockholm, Sweden)

Respiratory insufficiency usually means inadequate alveolar ventilation, which produces respiratory acidosis. When this is present, artificial ventilation through a tracheostomy is advocated by the authors, who cite 61 cases in which the procedure has been employed postoperatively.

The cases include 2 in which paradoxical movements of the chest wall followed upon multiple rib fractures; 1 with paradoxical chest wall movements after thoracoplasty; a number with ventilatory insufficiency due to massive infiltrations in the lungs; and others based upon deficiency of functioning lung tissue; fibrothorax with fixation of ribs and diaphragm; pulmonary edema; and central nervous system pathology.

This form of treatment appears to be of great practical value. Not only has it saved lives, but it also seems to permit acceptance of patients for surgery who ordinarily would be regarded as very poor risks.

Nine roentgenograms; 1 table.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Poisoning from Petroleum Distillates. The Hazards of Kerosene and Furniture Polish. A. Bradley Soule, Jr., and Joseph C. Foley. J. Maine M. A. **48:** 103–110, April 1957. (A. B. S., Mary Fletcher Hospital, Burlington, Vt.)

In 1953, the authors and their associates reported on a series of 101 children admitted to five Vermont hospitals following the accidental ingestion of kerosene. (Radiology **62:** 817, 1954). More than 60 additional patients have since been hospitalized for the same condition. Three children have died: 2 from the earlier series, as a result of kerosene poisoning, and a third following the ingestion of furniture polish.

The account of the roentgen findings is based on the 101 cases originally reported. Chest films were obtained in 54 of these. Forty-eight of the number showed "patchy clouding of varying intensity" closely correlated with the degree of toxicity noted clinically. This clouding was observed as early as thirty minutes after ingestion and became stabilized in four to six hours. The apices and outer portions tended to remain clear, even in the fatal cases. With severe damage, zones of emphysema were demonstrable, apparently as a compensatory phenomenon. All survivors were clinically improved within twelve hours after the accident and most were alert and clinically well or nearly well in twenty-four hours. Resolution of the roentgen changes lagged far behind clinical improvement.

Five roentgenograms are included, and two photomicrographs to demonstrate the "asphyxial membrane" lining the alveolar wall. Two photographs illustrate the carelessness which makes these accidents possible.

J. E. RHODENBAUGH, M.D.
The Henry Ford Hospital

Mediastinal Tumors: An Analysis of 141 Cases. Thomas G. Nelson, Lawrence M. Shefts, and Warner F. Bowers. Dis. of Chest **32:** 123–153, August 1957. (T. G. N., Brooke Army Hospital, Fort Sam Houston, Texas)

The authors report 141 cases of mediastinal enlargement observed from 1944 to 1956. One-half of the lesions were asymptomatic and were discovered on routine chest roentgenograms. No lesion produced pathognomonic symptoms, physical signs, or findings on ordinary roentgenograms. Twenty-three cases were diagnosed by lymph node biopsy and 5 by angiocardiography, although scalene node biopsy and angiocardiography were not generally used until the latter half of the period covered by this report. Radiation therapy as a diagnostic procedure may cause a dangerous delay in diagnosis of a malignant tumor or confusion due to spontaneous regression of a benign process such as sarcoidosis. Of 89 mediastinal tumors in which thoracotomy was the only means of establishing a diagnosis, 17 per cent were malignant. Only one of these lesions was completely removed. All but one of the benign tumors was resectable. There was no operative mortality.

In order of frequency, the most common mediastinal masses were lymphomas, neurogenic tumors, bronchogenic cysts, teratodermoids, and pericardial cysts. Because of their wide distribution and nonspecific appearance on roentgenograms, bronchogenic cysts were most often misdiagnosed. Three of them were attached to the trachea and rose into the neck, simulating goiter. Sixteen of the cases were not mediastinal tumor, cyst, or granuloma, but were difficult to differentiate. These included aneurysms, right-sided aorta, coarctation of the aorta, bronchogenic carcinoma, metastatic carcinoma, and atelectatic azygos lobe.

In conclusion, the authors point out that undiagnosed mediastinal tumors are dangerous for two reasons: the threat of malignancy and, in the case of benign tumors, of life-endangering complications.

Forty-five roentgenograms; 1 scanogram; 2 drawings; 1 table.

CAPT. GARTH R. DREWRY
MacDill AFB, Fla.

Intrathoracic Goitre: Its Prevalence in Sydney Metropolitan Mass Radiography Surveys. T. S. Reeve, Charles Rubinstein, and F. F. Rundle. M. J. Australia **2:** 149–152, Aug. 3, 1957. (Royal North Shore Hospital, Sydney, Australia)

One hundred and ninety-four cases of intrathoracic goiter were detected among an estimated total of 967,759 persons radiologically examined in the metropolitan area of Sydney, Australia, in the course of mass chest surveys between April 1953 and December 1956. For the purpose of this paper, a given subject was considered to have an intrathoracic goiter when this had been diagnosed radiologically in the chest clinic of the Anti-Tuberculosis Association, and when subsequent reexamination of small and large chest films failed to throw doubt on the diagnosis. One hundred and fourteen of the 194 patients were known to have a cervical goiter or a history of thyroidectomy. Forty-six of the patients were men and 148 women. In both sexes the frequency was relatively much higher in the older age groups, over 60 per cent of the patients being sixty or over.

The incidence of intrathoracic goiter among persons born in England was approximately three times that in native Australians and was also distinctly greater than among persons born on the mainland of Europe.

Evidence is provided that, whereas the seed of intrathoracic goiter is sown early in life, this type of goiter is characteristic of the later age groups.

THE HEART AND BLOOD VESSELS

The Effect of Myocardial Infarction on the Size of the Heart. Morris M. Weiss and Morris M. Weiss, Jr. Am. J. M. Sc. **234:** 129–135, August 1957. (Jewish Hospital Division, University of Louisville School of Medicine, Louisville, Ky.)

In a group of 489 patients who survived an acute myocardial infarction for at least two months, 25 showed cardiac enlargement, though the heart had been of normal size at the onset of the infarction. Heart size determinations in all instances were based upon fluoroscopy, with the added check of teleoroentgenograms in 129 patients. The cardiothoracic ratio was used as the index of heart size. A ratio exceeding 0.5 was held to indicate enlargement.

In 15 of the 25 patients there were commonly accepted causes of enlargement, *viz.*, hypertension, 13 cases; aortic stenosis, 1 case; cor pulmonale, 1 case. In 2 others the enlarged heart was not observed until quite late after the initial infarction and follow-up was inadequate. In the remaining 8 cases (2 per cent of total) enlargement could have been due to infarction. These cases are briefly reported. All patients in this group had associated congestive heart failure. Multiple myocardial infarctions did not otherwise cause cardiac hypertrophy.

Cardiac enlargement due solely to myocardial infarction is rare. There is speculation as to operative mechanisms, and conflicting points of view are expressed. The authors believe that such cardiac hypertrophy develops with congestive failure, which in turn results from complications of myocardial infarction, *viz.*, myocardial aneurysm or extensive myocardial fibrosis, or both.

Two tables.

JOHN F. RIESSER, M.D.
Springfield, Ohio

The Safety of Intravascular Carbon Dioxide and Its Use for Roentgenologic Visualization of Intracardiac Structures. Thomas M. Durant, H. M. Stauffer, M. J. Oppenheimer, and Robert E. Paul, Jr. Ann. Int. Med. **47:** 191–201, August 1957. (T. M. D., Temple University School of Medicine, Philadelphia 40, Penna.)

The authors point out the inherent danger of the use of air within body cavities for diagnostic purposes. Oxygen is equally dangerous, since its solubility in plasma is little different than that of air. Carbon dioxide, on the other hand, being twenty times more soluble in serum than air or oxygen, is an ideal gas for intravascular injection, for the demonstration of intracardiac structures.

Animal experiments showed no untoward effects from the intravenous injection of up to 7.5 c.c. of CO_2 per kilogram. Experimentally produced pericardial effusions were demonstrated, and the technic was found to afford good visualization of the inferior vena cava, right atrium, right ventricle, and the pulmonary valve. Direct injection of the left side of the heart allowed visualization of the left ventricle, the outflow tract, and the aortic valve.

Following the demonstration of the safety of CO_2 injections in dogs, the authors cautiously used the same technic in man, but with smaller amounts of gas. Successful demonstration of pericardial disease—or its absence—was accomplished in 7 patients.

It is emphasized that the CO_2 should be 100 per cent pure and that the injection system should be free from possible leaks. Any systemic vein may be used for the injection.

CO_2 injected directly into the vascular system has practical value as a supplementary procedure in the diagnosis of pericardial disease, and for this purpose about 50 c.c. is sufficient. To visualize the outflow tract and pulmonary valve, a larger amount (100 c.c.) may be necessary. The only absolute contraindication to the procedure is a pulmonary emphysema or fibrosis, with impairment of the excretory mechanism for CO_2. Though the left heart was successfully injected in animals, it is suggested that there is some need for caution in this respect, since the experimental study showed persistence of a small gas bubble, containing as much as 20 per cent oxygen, above the level of the left ventricular outflow tract.

Five roentgenograms.

DAVID L. ROBINSON, M.D.
Bowman Gray School of Medicine

Fatal Intracardiac Embolization from Indwelling Intravenous Polyethylene Catheter. William B. Ayers. Arch. Surg. **75:** 259–262, August 1957. (Kings County Hospital, Brooklyn 3, N. Y.)

A 33-year-old white man was operated upon, first for a perforated gangrenous appendicitis with peritonitis and ten days later because of intermittent mechanical small-bowel obstruction due to adhesions. Two days after the second operation, a polyethylene catheter which had been placed in an antecubital vein of the right arm, and through which the patient had been receiving parenteral fluids and antibiotics, disappeared. Thorough search was unavailing. Repeated roentgenograms of the arm and chest were uninformative.

The further course was extremely "stormy," with multiple wound complications, the development of pulmonary abscesses, and subsequent caval ligation for suspected pelvic suppurative endophlebitis. The situation became worse and, after total hospitalization of about sixty-five days, death ensued.

Autopsy revealed the polyethylene catheter in the right heart. There was an extensive acute endocarditis, which accounted for the pulmonary abscesses.

With proper precautions, this case might have been salvaged. If the catheter had been radiopaque, which it was not, it might easily have been detected and localized by x-ray. The author lists and diagrams the routine precautions which he now employs to avoid any such occurrences in the future. Complete sterile technic is used to prevent phlebitis. In addition to a suture tied around the catheter as it enters the skin, a "half-hitch" is taken in the catheter itself before attaching it to the needle and adapter leading to the infusion bottle. This results in a large loop knot if the catheter is pulled. A drop of collodion is placed on the catheter as it enters the skin. Tape is placed across the knot.

Three roentgenograms; 2 photographs; 1 diagram.

JOHN F. RIESSER, M.D.
Springfield, Ohio

Radiologic Aspects of Operable Heart Disease. V. The Appearance of Coarctation of the Aorta in Infancy. Herbert L. Abrams. Stanford M. Bull. **15:** 233–241, August 1957. (Stanford University School of Medicine, San Francisco 15, Calif.)

Coarctation of the aorta is a common cause of congestive heart failure in infancy and a remediable one. Seventeen proved cases in infants under six months of

age (the youngest two and a half weeks) were analyzed. On conventional roentgenograms gross cardiac enlargement and pulmonary congestion were constant features. Marked right ventricular enlargement was invariably present. Except for rib notching in a single case, the characteristic changes in the aorta and collateral circulation described in adult patients were not seen. Retrograde brachial aortography was done in each instance to confirm the diagnosis and outline the degree and length of the stenotic segment. In 2 cases there was complete interruption of the aortic arch with flow from the pulmonary artery to the descending thoracic aorta through a patent ductus. In one case there was hypoplasia of almost the entire arch. Fourteen cases showed localized zones of narrowing in the aortic isthmus (the segment of aorta between the origin of the left subclavian artery and the ligamentum arteriosum). In all cases there was significant poststenotic dilatation. The size of the left subclavian artery was also markedly increased in most patients.

One case was unique in that the stenotic segment was proximal to not only the left subclavian artery but to an aberrant right subclavian vessel as well. This infant presented with episodes of gasping and cyanosis. The pulse and blood pressure were diminished in both upper and lower extremities. A retrograde aortogram showed the left subclavian arising from what appeared to be a poststenotic dilatation of the descending aorta, and an angiocardiogram demonstrated the involved segment and aberrant vessel. This unusual form should be suspected when there are bounding carotid pulses associated with faint pulses in the extremities, but the clinical distinction from severe aortic stenosis or "pulseless" disease cannot always be made.

The author feels that on the basis of clinical findings and prognosis, the traditional separation of coarctation into "infantile" and "adult" or "preductal" and "postductal" is not warranted and should be discarded. On the whole, the results of medical therapy for the control of congestive failure in these infants have been relatively poor. If it fails, definitive surgery before the optimal age period may be successful.

Twelve roentgenograms; 2 drawings; 1 table.

LAWRENCE A. POST, M.D.
University of California, S.F.

Dissecting Aneurysm of the Thoracic Aorta: Its Roentgen Recognition. Stanley M. Wyman. Am. J. Roentgenol. **78:** 247–255, August 1957. (Department of Radiology, Massachusetts General Hospital, Boston 14, Mass.)

The natural course of dissecting aneurysm of the thoracic aorta ends with death within five weeks in about 96 per cent of cases. Survivors usually show a re-entry of the dissected hematoma back into the true lumen of the aorta or iliac arteries. This has led surgeons to attempt to create an artificial point of re-entry into the aorta as a means of curbing the progression of the lesion. For this reason, there is now some practical importance to its prompt roentgen recognition.

A degenerative process in the media of the aorta with cystic changes and hemorrhages from the vasa vasorum leads to the separations of the middle and outer coats by gradual coalescence of diseased areas. Associated transverse tears occur in the intima of the supravalvular portion or just beyond the origin of the great vessels near the ligamentum Botalli. Blood under systemic pressure enters the area of dissection, causing its progression and in many instances rupture into the pericardium (70 per cent), pleura, mediastinum, peritoneal cavity, and retroperitoneal tissue. Hypertension is frequently related; arteriosclerosis is not an important factor *per se;* syphilis is not believed to be a causative factor. Clinical features vary widely, but usually include severe shocking pain, often related to the site of dissection.

The author describes the findings on plain film studies in 16 proved cases; in 13 these were regarded as typical. Definite change in aortic diameter between two successive examinations, particularly in the descending portion on postero-anterior and lateral views, was the most characteristic sign. Less common observations are a convex or angular prominence of ascending aortic border above the right heart border, an irregular, knobby appearance of the outer profile of all or most of the thoracic aorta, and plaques of calcium in the aortic wall several millimeters from the outer margin. A fuzzy or indistinct outline of the ascending or descending portion was correlated with rupture and associated hemorrhage in 7 cases.

Eleven roentgenograms; 1 table.

JOHN A. CAMPBELL, M.D.
Indiana University Medical Center

Chylothorax as a Complication of Translumbar Aortography. Max R. Gaspar and Pettus G. Secrest. Arch. Surg. **75:** 193–196, August 1957. (211 Cherry Ave., Long Beach 2, Calif.)

Recorded cases of thoracic complications of translumbar aortography are few. The patient whose case is reported here was suspected of having an aneurysm of the abdominal aorta. Translumbar aortography was performed. Three insertions of a 6-inch needle were required before it was finally placed in proper position in the aorta, above the origin of the celiac axis. The aortogram showed some tortuosity of the vessel but no aneurysm.

Four days after the examination the patient was seen because of dyspnea, pain, and cough. Chest films revealed bilateral hydrothorax. Thoracentesis yielded chyle. At thoracotomy a tributary of the thoracic duct was found to be severed and was ligated. Recovery was complete.

The thoracic duct measures from 2 to 6 mm. in diameter and lies behind and slightly to the right of the aorta as it traverses the aortic hiatus of the diaphragm at the point where the puncture is usually made for this procedure. If the needle misses the aorta the thoracic duct may be damaged. In order to produce chylothorax it is not necessary that the pleura be injured. The chyle will pool in the retropleural space and cause pressure necrosis in about three to seven days and then pour into the pleural space. Direct surgical attack with ligation is recommended to effect a cure.

Two roentgenograms.

JOHN F. RIESSER, M.D.
Springfield, Ohio

Visualization of Aortic and Arterial Occlusion by Percutaneous Puncture or Catheterization of Peripheral Arteries. Sven I. Seldinger. Angiology **8:** 73–86, February 1957. (Karolinska Sjukhuset, Stockholm, Sweden)

In attempts at arteriographic visualization of aortic or arterial occlusion, it is frequently difficult to assess the correct point of injection of contrast medium proximal to the lesion. This can generally be achieved, however, by percutaneous puncture of the peripheral arteries

alone or in combination with percutaneous catheterization. It is possible to obtain good roentgenograms with small quantities of contrast material of the Perabrodil or Diodrast type, except in thoracic aortography, where larger amounts of medium are necessary. Details of the catheter method were given in an earlier paper (Acta radiol. **39:** 368, 1953. Abst. in Radiology **63:** 466, 1954).

The author describes technics suitable for coarctation of the aorta; occlusion of the abdominal aorta and bilateral occlusion of the iliac arteries; arterial occlusion in the shoulder, axillary, and brachial regions; arterial occlusion in the forearm and hand; unilateral occlusion of the iliac artery, arterial occlusion in the thigh and proximal part of the calf; and arterial occlusion in the distal part of the calf and foot.

Possible complications and their avoidance are discussed.

Ten roentgenograms; 4 diagrams.

Evaluation of Diatrizoate (Hypaque) in Peripheral Angiography and Aortography. Theodore B. Massell, S. M. Greenstone, and E. Craig Heringman. J.A.M.A. **164:** 1749–1752, Aug. 17, 1957. (T. B. M., 6317 Wilshire Blvd., Los Angeles 48, Calif.)

The authors review the literature on complications associated with various contrast substances used in angiography and relate particularly their own experience with 100 injections of diatrizoate salts administered to 83 patients, for vascular opacification. Both the sodium salt (Hypaque) and a mixture of the sodium and methylglucamine salts were employed. Phlebography was carried out in 42 patients, peripheral arteriography in 28, and aortography in 13.

In phlebography the opacification of the veins seemed generally more intense than that obtained with iodopyracet (Diodrast). Sixty-two per cent of cases in which a mixture of the methylglucamine salts was used showed excellent intensity of vascular shadows, as compared with 37 per cent for the sodium salt alone.

For peripheral arteriography, 36 injections were done in 28 cases. No systemic reactions were encountered. Approximately 45 per cent of the patients complained of pain or burning in the injected leg after the pure sodium salt was used. The opacification was excellent in 73 per cent with the sodium salt and 86 per cent with the mixture.

A 90 per cent solution of the mixture of methylglucamine and sodium salts was tried for aortography after failure to obtain satisfactory opacification with a 50 per cent solution of the sodium salt. Because of its viscosity, however, the 90 per cent preparation was difficult to inject rapidly through the 17-gauge thin-walled needle used. Filling of the collateral channels was also poor. The authors then resorted to a 70 per cent solution of the mixed salts. Twenty to 30 c.c. was easily injected and opacity was fairly satisfactory. The most striking thing in these cases was complete absence of any discomfort. No systemic reactions occurred.

Blood-brain barrier studies in the rabbit revealed slight evidence of extravasation of diatrizoate, either the pure sodium salt or a mixture of methylglucamine and sodium salt. With both iodopyracet and acetrizoate there was marked evidence of extravasation.

In conclusion, the authors state that diatrizoate (Hypaque) produces considerably fewer untoward general and local reactions than the other commonly used organic iodine compounds for intravascular opacification. The mixture of the methylglucamine and sodium salts appears to be better tolerated and to give more intense opacification than the sodium salt alone.

Two roentgenograms.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Postoperative Venographic Control Following Ligation of the Inferior Vena Cava. V. Gvozdanović, R. Ivančić, and A. Hahn. Acta radiol. **48:** 81–92, August 1957. (University Hospital 'Rebro', Zagreb, Yugoslavia)

The authors noted varying clinical results following operative ligation of the inferior vena cava in 30 decompensated cardiac patients. Ligation was performed inferior to the point of entrance of the renal veins. In 5 cases postoperative venograms of the inferior vena cava were obtained in an effort to demonstrate collateral circulation following ligation, compare types of collateral circulation with clinical results and, if possible, draw prognostic conclusions from the type and rate of collateral circulation.

A brief but complete history of studies of the inferior vena cava and its collateral circulation is given. Detailed anatomic considerations are discussed thoroughly, including the external and internal vertebral venous plexuses, the lumbar venous system, and its anastomosis.

In the 5 cases studied by the authors, venography was done five to fifteen weeks following ligation. In 4 patients ligation was performed for the diagnosis of mitral disease with decompensation, and in the remaining case for recurring exudative polyserositis and pleuropericarditis with subsequent decompensation. Thirty milliliters of Joduron 50 per cent was injected simultaneously into both internal saphenous veins at the rate of 10 mm. per second. Rapid film-changer technic was used in all except 1 case, in which the cassettes were changed manually. Duration of the serial exposure was fourteen to twenty-one seconds. No untoward effects or complications were noted.

The authors observed that lumbar vein system (iliolumbar veins, lumbar ascending veins and lumbar veins) and the external and internal venous vertebral plexuses were the most important for the development of collateral circulation. These veins were demonstrated in all 5 cases, usually on the left, but their caliber was small except in one case. It was noted that in all cases essentially all of the contrast medium emptied through the collaterals into the inferior vena cava above the point of ligation. The authors state that it is surprising how quickly the contrast medium reaches the upper two-thirds of the inferior vena cava despite the ligation. In no instance did this transit time exceed six seconds.

The collateral circulation observed by the authors after ligation of the inferior vena cava differed from that reported by others. The difference would seem to reflect the type of patients and technic employed. In patients upon whom emergency ligation of the inferior vena cava is performed, there is no disposition in the venous system for development of collateral circulation. Conversely, in patients with chronic cardiac decompensation, stasis in the inferior vena cava system and its collaterals exists prior to ligation and probably favors development of collateral circulation.

The authors observed coincidence of slow emptying of the inferior vena cava and good clinical effect after ligation of the vena cava and state that this should be

studied further. The prompt development of extensive collateral circulation may explain the absence of clinical improvement following ligation of the vena cava and the question arises whether it is of benefit to perform the operation under such circulatory conditions. In the future, it may be possible to occlude the inferior vena cava temporarily and study the collateral circulation by contrast media in an effort to evaluate the benefit to be derived from ligation. The authors urge further investigation of this possibility.

Ten roentgenograms; 1 drawing.

CAPT. BYRON G. BROGDON
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Anomalous Pulmonary Venous Drainage of Right Lung into Inferior Vena Cava with Malrotation of the Heart: Report of Three Cases. Israel Steinberg. Ann. Int. Med. **47:** 227–240, August 1957. (I. S., 525 E. 68th St., New York 21, N. Y.)

Three cases of anomalous pulmonary venous drainage of the right lung into the inferior vena cava are added to 3 previously reported from the same institution (Dotter, *et al.*: Am. J. M. Sc. **218:** 31, 1949; Sepulveda, *et al.* Am. J. Med. **18:** 833, 1955. Abst. in Radiology **54:** 906, 1950; **66:** 624, 1956) and 1 to be reported (Steinberg and Lukas), giving a series of 7.

Six of the 7 patients were without symptoms, and the anomaly was discovered on routine chest films. A heart murmur was present in only 1 patient. In the 3 cases reported here, with dextroposition of the heart, the heart sounds were more evident to the right of the sternum.

A common feature observed in 6 cases was the appearance, in the conventional frontal roentgenogram, of a broad, multiple-branching channel curving in crescentic fashion near the right cardiac border and descending toward the right cardiohepatic region. This characteristic vascular deformity adjacent to the right cardiac silhouette could still be detected in the cases reported here, despite dextrorotation of the heart, although in 1 case the anomalous vessels were so obscured by the heart that an over-penetrated film was required for their demonstration.

Angiocardiography, by visualizing the course of the anomalous pulmonary venous system as it enters the inferior vena cava, provides the definitive diagnosis. In 2 of the author's 3 cases it established the diagnosis and was useful in indicating the degree of cardiac and pulmonary arterial rotation.

One patient was operated upon, and the right lung was found to be devoid of fissures and unilobular. Its lower portion was densely attached to the diaphragm, which was partially eventrated, suggesting that multiple thoracic abnormalities may be associated with aberrant right pulmonary venous drainage into the inferior vena cava.

Conditions to be considered in the differential diagnosis are arteriovenous fistula, congenital absence of the right pulmonary artery, and anomalous systemic arteries from the abdominal aorta entering a hypoplastic right lung.

Asymptomatic patients with this anomaly require no treatment. Patients with dyspnea, recurrent pulmonary infections and plethora of the lungs should be suspected of having an associated cardiac lesion such as interatrial septal defect.

Eight roentgenograms.

C. FRED TAYLOR, M.D.
Bowman Gray School of Medicine

The Varied Clinical Manifestations of Pulmonary Embolism. Harold L. Israel and Franz Goldstein. Ann. Int. Med. **47:** 202–226, August 1957. (H. L. I., 304 S. 19th St., Philadelphia 3, Penna.)

The authors consider pulmonary embolism to be of much more frequent occurrence than has been generally recognized. In the Graduate Hospital of the University of Pennsylvania, it was recently found to be the most common disease of the lungs, outnumbering pneumonia and bronchogenic carcinoma. Ninety cases were discovered in a period of eighteen months. Thirty-three cases followed surgery, and 6 musculoskeletal trauma. In 18 instances the patients had been hospitalized for medical illnesses, and in 33 embolism had occurred prior to hospital admission.

Respiratory symptoms were predominant in 39 cases and cardiovascular symptoms in 33. Abdominal symptoms were most prominent in 6 patients and central nervous system manifestations in 4. The disease most often requiring differentiation from embolism was acute myocardial infarction.

Chest roentgenograms were of importance for the diagnosis. While the findings are not pathognomonic, they are sufficiently suggestive that embolism was considered as a possibility in 52 per cent of 67 patients examined. A detailed analysis of the roentgen observations is not presented here. Electrocardiographic abnormalities were detected in 70 per cent of cases adequately examined, consisting most frequently in transient positional changes, coronary insufficiency patterns, and, more rarely, patterns of acute cor pulmonale.

Serum glutamic oxalacetic transaminase determinations were made in 49 patients, and when this level was elevated, associated hepatic, myocardial, or musculoskeletal disease could usually account for the elevation.

The authors believe that, when the diagnosis is given first consideration in a wide variety of syndromes, and chest films, electrocardiograms, and serum transaminase determinations are made, pulmonary embolism will be more frequently recognized.

Fourteen tables.

DAVID H. NEWBERN, M.D.
Bowman Gray School of Medicine

Roentgen Manifestations of Pulmonary Arteriovenous Fistula. Diagnosis and Treatment of Four New Cases. Israel Steinberg and Nathaniel Finby. Am. J. Roentgenol. **78:** 234–246, August 1957. (I. S., 525 East 68th St., New York 21, N. Y.)

Four patients with pulmonary arteriovenous fistulas are the subject of this report. They underwent pneumonectomy, lingulectomy, lobectomy, and segmental resection respectively. The fistulas as seen on conventional chest films varied in size and shape from minute circular shadows to large oval lesions. In 3 patients the vague and ill-defined edges simulated pulmonary infiltrates. In 1 patient a localized hilar increase of the pulmonary vessels suggested the diagnosis; oblique and lateral views indicated that the increased vascular system was related to the segmental or lobar pulmonary blood supply. The afferent and efferent vascular connections of pulmonary arteriovenous fistulas may be difficult to visualize with conventional roentgenography but are readily seen with angiocardiography.

With 9 cases of pulmonary arteriovenous fistula previously reported from the New York Hospital-Cornell Medical Center (Steinberg and McClenahan: Am. J. Med. **19:** 549, 1955. Abst. in Radiology **67:** 295,

1956), from which this report comes, the authors have a series of 13 cases as a basis for their discussion. Only 2 of the 13 patients exhibited the classic syndrome of cyanosis, clubbing of the fingers, and polycythemia. A bruit heard over the pulmonary fistula was present only twice. One patient with dyspnea, fatigue, and familial hemorrhagic telangiectasis, had bilateral fistulas. Five patients were asymptomatic. The lesion was responsible for symptoms in 8, and in 3 of these acute cerebral conditions (brain abscess, meningoencephalitis, and hemiplegia) were present.

Pulmonary arteriovenous fistulas are hereditary hemangiomatous malformations of the pulmonary vascular bed. Four of the 13 patients had associated cutaneous and mucosal hemangiomas, indicating a close relationship to familial telangiectasis (Rendu-Osler-Weber disease). When there is rupture of the paper-thin pulmonary vascular wall hemoptysis may occur. Cerebral symptoms are due either to cerebral thrombosis or to the polycythemia and infection, especially brain abscess.

Pulmonary densities with hilar vascular connections localized to lobes or segments of the lungs, and increased hilar vascularities, should arouse suspicion of an arteriovenous fistula even on conventional films. Change in size of the lesions after respiratory maneuvers (Valsalva or Müller) and demonstration of the afferent arterial and efferent venous connections by body-section films may be confirmatory. Angiocardiography establishes the diagnosis and is especially recommended for preoperative evaluation.

Surgical excision is the treatment of choice. It is usually curative and should be done even in asymptomatic patients, since the hazard of brain abscess, fatal hemoptysis, or development of cerebral thrombosis outweighs the morbidity and mortality of lobectomy or segmental resection.

Nineteen roentgenograms; 3 photographs.

WILLIAM M. LOEHR, M.D.
Indiana University Medical Center

The Arterial Bed of the Lung in Pulmonary Hypertension. D. S. Short. Lancet **2**: 12–15, July 6, 1957. (Middlesex Hospital, London, England)

Sixty-six lungs removed at necropsy were studied by a combination of arteriography and histology. Thirty-two of these were from patients with pulmonary hypertension, including mitral stenosis, congenital heart disease, chronic lung disease, recurrent pulmonary embolism, and solitary pulmonary hypertension.

In every case of pulmonary hypertension a great reduction was found in the pulmonary arterial bed. In addition to thrombosis in the larger arteries, there were two forms of peripheral arterial narrowing: (1) intimal proliferation, in which thrombosis with subsequent organization probably played a part; (2) a diffuse arterial contracture, a state of persistent organic narrowing and indistensibility. Intimal proliferation has long been recognized, though its extent has been underestimated; arterial contracture, however, has been mistaken for hypertrophy because of the thickened walls of the contracted arteries.

Structural changes in the lung arteries in pulmonary hypertension are far more extensive than has been supposed. They are of the greatest importance in maintaining the hypertension and are responsible for its serious prognosis and resistance to treatment.

Five arteriograms; 6 photomicrographs; 1 chart.

Aneurysm of Hepatic Artery: Roentgenologic Features In One Case. André J. Bruwer and George A. Hallenbeck. Am. J. Roentgenol. **78**: 270–272, August 1957. (The Mayo Clinic, Rochester, Minn.)

A case is reported in which a sudden onset of abdominal pain with evidence of internal hemorrhage was followed by tarry stools and then the passage of bright blood. An upper gastrointestinal tract study showed a smooth filling defect in the first portion of the duodenum which closely simulated a gallbladder impression but, when additional studies three days later showed an increase in the deformity and irregularity in outline, the lesion was considered to be an ulcerating leiomyoma. Another episode of internal hemorrhage followed, and at operation an aneurysm of the hepatic artery was found, closely adherent to the posterior surface of the duodenal cap. Subsequent necropsy established recurrent hemorrhage from an arteriosclerotic aneurysm of the hepatic artery as the cause of death.

In their discussion the authors review the literature on aneurysm of the hepatic artery and cite the triad of pain, hemorrhage, and jaundice as characteristic. Roentgenographically, calcification in the wall of the aneurysm may be seen or, as in this case, a pressure defect on the duodenum, which should prompt further diagnostic studies, as cholangiography and aortography.

Four roentgenograms.

GEORGE L. SACKETT, M.D.
Cleveland, Ohio

Radiological Aspects of Portal Hypertension. H. G. Hiller. M. J. Australia **2**: 278, Aug. 24, 1957. (Royal Children's Hospital, Melbourne, Australia)

This report pertains to findings in 17 cases of suspected portal hypertension in children, studied by percutaneous splenoportography. (The author uses the term splenic portagram). The procedure is done under general anesthesia, with a respiratory depressant to inhibit diaphragmatic movement. A wide-bore, short-bevel needle is used to puncture the spleen. Portal pressure is recorded, and 15 to 20 c.c. of 70 per cent Urokon is injected. A series of 10 films is exposed at one-second intervals, the first exposure being made one second after the beginning of the injection. No morbidity was encountered in this series.

In the 17 cases studied, two pathological conditions were demonstrated as causes of portal hypertension. Cirrhosis accounted for only 3 cases, whereas cavernomatous malformation of the portal vein, probably secondary to thrombosis, was found to be present in 9 cases. In the remaining 5 cases, portal hypertension was disproved by the investigation.

The radiographic appearance of cavernous malformation of the portal vein consists in absence of the normal vein and its replacement by numerous thin-walled veins following a tortuous course into and through the liver substance.

Thirteen roentgenograms.

J. S. ARAJ, M.D.
Toledo, Ohio

Duodenal Varices Due to Portal Hypertension from Arteriovenous Aneurysm. Report of a Case. H. Brownell Wheeler and Richard Warren. Ann. Surg. **146**: 229–238, August 1957. (VA Hospital, West Roxbury, Mass.)

A case of fistula between an hepatic artery aneurysm and the portal vein is reported. This is believed to be the third such case in the world literature, and the first diagnosed and treated during life. After three laparot-

omy procedures for control of bleeding duodenal varices and splenorenal venous anastomosis, a definite diagnosis was established through demonstration of the aneurysm by lumbar aortography and detection of a "machinery" murmur over the epigastrium. The presence of contrast material in several enlarged venous channels of the portal system indicated a fistulous communication with these veins.

Therapy consisted of aneurysmorrhaphy and wiring. Despite a short episode of recurrence of the murmur, the subsequent clinical result was satisfactory.

Four roentgenograms. CAPT. NEIL E. CROW
Parks AFB, Calif.

Cavernous Transformation of the Portal Vein Following Umbilical Sepsis. K. Somers. Brit. M. J. **2:** 335–336, Aug. 10, 1957. (Hospital for Sick Children, Great Ormond St., London, England)

Cavernous transformation of the portal vein is one of the causes of extrahepatic portal obstruction. It has been postulated that the lesion is a true venous angioma. On the basis of postmortem findings, Parker and Seal (J. Path. & Bact. **70:** 97, 1955) regarded thrombosis of the portal vein and its tributaries as of major importance in the pathogenesis of cavernous transformation, recanalization, and the development of collateral circulation resulting in the cavernous picture.

The author reports a case in a 9-year-old girl, diagnosed by percutaneous splenoportography. The significance of this case lies in the fact that a documented history of neonatal umbilical sepsis at the age of seventeen days was obtained, supporting the theory that thrombosis of the portal vein is a complication of intra-abdominal infection. The patient suffered from mild attacks of upper abdominal pain and bruised easily. Splenomegaly was the only abnormal physical finding. Blood studies revealed only mild anemia, leukopenia and thrombocytopenia. On splenoportography, the splenic pressure was 10 mm. Hg, and the opaque medium demonstrated cavernous transformation of the portal vein.

One roentgenogram. J. S. ARAJ, M.D.
Toledo, Ohio

Percutaneous Transfemoral Selective Renal Arteriography (Including Cineradiology). D. McC. Gregg, J. M. Allcock, and F. R. Berridge. Brit. J. Radiol. **30:** 423–435, August 1957. (Addenbrooke's Hospital, Cambridge, England)

The authors appraise methods of renal angiography and list the disadvantages of translumbar aortography, and also of transfemoral aortography.

When information concerning the status of the renal arteries is of primary concern, the authors prefer a method of selective renal arteriography performed by percutaneous transfemoral catheterization of the renal arteries. The technic, based on that of Ödman (Acta radiol. **45:** 1, 1956. Abst. in Radiology **67:** 773, 1956), is described in detail.

With this selective procedure, the necessity for a general anesthetic is obviated. Other advantages are the supine position of the patient; avoidance of injection into lumbar arteries and into the celiac axis and the superior mesenteric arteries, which may mask the pattern of renal vasculature; lower injection pressure; decreased concentration of medium; decreased amount of radiation to the abdomen and gonadal areas.

The authors state that by this technic a quantity and concentration of contrast medium are injected which, so far as is known, would not cause any damage even if the injection were misdirected. Further, there is no danger of damage to the renal or other tissues due to application of high pressure, as no pressure apparatus is used. One person has performed the fluoroscopic screening while another has positioned the catheter, but the authors state that with an indirect method of image intensification it would be possible for the entire procedure to be performed by one person.

Thirty-six roentgenograms; 2 photographs.

JAMES E. BAUER, M.D.
Victoria, Texas

Renal Artery Aneurysms. Robert McLelland. Am. J. Roentgenol. **78:** 256–265, August 1957. (Memorial Hospital, Danville, Va.)

Four proved cases of renal artery aneurysm are reported. Two suspected renal artery aneurysms are also presented together with cases illustrative of lesions which may simulate renal artery aneurysm radiographically when aortography is not utilized to establish their true nature. These latter conditions comprise calcification in benign cyst, calcified splenic artery, osteochondroma of the lumbar spine, gallstone, renal abscess, and tuberculosis. The cases proved by aortography included bilateral renal artery aneurysms, one extrarenal and one intrarenal; an external aneurysm involving the major arterial branch; a multiloculated intrarenal aneurysm; a saccular intrarenal aneurysm.

Thirty-two roentgenograms; 1 photograph; 1 drawing. GEORGE L. SACKETT, M.D.
Cleveland, Ohio

Aneurysm of the Renal Artery. Heino Provet, Jere W. Lord, Jr., and James R. Lisa. Am. J. Roentgenol. **78:** 266–269, August 1957. (H. P., 745 Fifth Ave., New York 22, N. Y.)

A case of true renal artery aneurysm diagnosed preoperatively by intravenous pyelography is reported. This aneurysm presented as an annular calcification situated above and medial to the renal pelvis and retained this relationship on various oblique projections. It was essentially asymptomatic. At nephrectomy the diagnosis of aneurysm was confirmed and it was found to arise at the bifurcation of the main renal artery. The illustrations comprise numerous intravenous pyelographic studies together with photographs and a roentgenogram of the surgical specimen and a photomicrograph of the aneurysm.

GEORGE L. SACKETT, M.D.
Cleveland, Ohio

Arteriographic Manifestations of Peripheral Occlusive Vascular Disease, with the Report of Two New Signs. Alexander R. Margulis, Charles M. Nice, Jr., and Thomas O. Murphy. Am. J. Roentgenol. **78:** 273–282, August 1957. (A. R. M., University of Minnesota Medical School, Minneapolis, Minn.)

Femoral arteriograms obtained on 84 patients are reviewed in this paper. On the basis of this study the radiographic findings which ordinarily might be expected with occlusive vascular disease are presented in considerable detail.

Occlusions of the arteries in the lower extremities may occur in association with isolated arteriosclerosis; with the arteriosclerosis of syphilis or diabetes; or with the arteriosclerosis which is complicated by hyperten-

sion. In addition to occlusion (which does not need to be complete to produce intermittent claudication) the arterial disease sometimes is manifested by microaneurysm formation and by clubbing of the vessels. These phenomena, apparent only on arteriograms, consist of small outpouchings on the sides of the vessels or of dilatation at the ends of small vessels.

In patients with isolated arteriosclerosis occlusions tend to involve the popliteal artery or the large thigh vessels more frequently than in the other groups. These patients are also more likely to have good collateral vessels, and fewer evidences of the microaneurysm or clubbing.

The patients with arteriosclerosis in association with diabetes quite often show poor collaterals. Microaneurysms and clubbing are relatively more common than in the other groups. A disproportionate number of diabetics are encountered in the younger age groups, and the occlusions in leg vessels outnumber those in the large thigh vessels.

In the hypertensive patients the sites of occlusion are about the same as in the isolated arteriosclerosis group, but clubbing and microaneurysm formation are more common.

Syphilitic patients show nonspecific findings consistent with the intimal proliferation which appears in the disease, especially clubbing without microaneurysms.

Nine roentgenograms; 12 tables.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Angiographic Studies in Benign Tumors of the Extremities. I. Th. Tiwisina. Fortschr. a. d. Geb. d. Röntgenstrahlen **87:** 199–205, August 1957. (In German) (Chirurgische Universitätsklinik, Münster, Westphalia, Germany)

Angiography is important for studying altered circulation as well as for localization and preoperative classification of tumors of the extremities. The method represents a distinct contribution to an understanding of such lesions, as the degree of malignancy is closely related to the type of tumor vascularization. Neoplasms can be divided into highly and poorly vascularized types.

The angiogram of a benign neoplasm is characterized by a certain regularity and orderly branching of its vessels. The arteries are usually distorted, displaced or compressed. In contrast to findings in malignant lesions there is absence of arteriovenous fistulae, except in arteriovenous angioma, and no tumor pooling of vessels. The latter can always be traced to the finest branches and the tumor is frequently well demarcated in the capillary phase.

Angiograms of juvenile *bone cysts* and *giant-cell tumors* show no specific features. In *angiofibroma* of bone there is hypervascularization with wide and tortuous vessels having a regular contour. In the capillary and venous phase there is diffuse staining of the mass, with a well demarcated lobulated border. In *angiochondroma* the arteries spread from the periphery toward the center and show a regular network of branches. In *lipoma* and *fibroma* only the arteries surrounding the tumor may be displaced, while occasionally the benign nature is recognized by gradual branching of arteries to capillaries in a regular fashion.

In the pure *arterial angioma* there is aneurysmal dilatation of medium-size arteries and an atonic arterial network without venous connection. The *arteriovenous angioma*, however, contains large lakes which bypass the capillary system and drain directly into the veins. Due to this arteriovenous shunt the circulation is considerably diminished in the peripheral parts of the extremity.

Eight representative cases are briefly reported.

Eight roentgenograms; 1 photograph.

ERNEST KRAFT, M.D.
Northport, N. Y.

Angiographic Studies in Malignant Tumors of the Extremities. II. Th. Tiwisina. Fortschr. a. d. Geb. d. Röntgenstrahlen **87:** 206–211, August 1957. (In German) (Chirurgische Universitätsklinik, Münster, Westphalia, Germany)

Angiography has proved helpful in the differential diagnosis of malignant tumors of the extremities and in determining the degree of malignancy. The vessels have a distinct embryonal character, and a distinction between arteries and veins frequently becomes impossible. Due to lack of elasticity and contractility of vessel walls, blood pools are easily formed. Areas of hypervascularization frequently alternate with avascular zones of necrosis.

The angiogram of *sarcoma* is characterized by dilatation of large arteries at the point of entry into the tumor. The proximal arteries have an irregular lumen, which either tapers or changes suddenly into a disorganized vascular network. There are areas of blood pools or lakes and of arteriovenous fistulae, as well as racemose and serpiginous formations of vessels and tissue staining. Contrast material remains longer in the sarcoma than in the surrounding normal musculature, and it accumulates preferably in the marginal portions of the tumor. In *osteogenic sarcoma* the same pattern is noted only after the tumor has perforated into the surrounding soft tissues.

Metastatic carcinoma in soft tissues is recognized chiefly by soft-tissue staining, but within the long bones it causes crowding of surrounding arteries and marginal capillary-venous staining.

Five cases are briefly reported and are well illustrated with arteriograms.

Seven roentgenograms; 1 photograph.

ERNEST KRAFT, M.D.
Northport, N. Y.

THE DIGESTIVE SYSTEM

A New Approach to the Physiology of So-Called "Cardiospasm." Experimental Production of "Cardiospasm" in Cats After Destruction of Auerbach's Plexus. L. Deloyers, R. Cordier, and A. Duprez. Ann. Surg. **146:** 167–177, August 1957. (Hôpital Saint-Pierre, Brussels, Belgium)

It is possible to produce experimental "cardiospasm" in cats by the injection of 5 per cent phenic acid solution between the two coats of smooth muscle which lie in the wall of the cardia. Following the injection, a disease develops which is identical clinically, radiologically, and anatomically with human achalasia. Microscopic lesions typical of the human disease are observed. The essential feature is destruction, more or less severe, of the ganglion cells of Auerbach's plexus, confirming the view that cardiospasm is a disturbance of the local nervous system. The authors believe, however, that the injection of phenic acid pro-

duces diffuse nervous lesions in the area, resulting in complete enervation of the affected segment.

It is observed that cardiac stenosis does not disappear immediately after death of the animal. This is probably because the circular muscular fibers reach a state of permanent "rest," which is explained by the experiments of Mangus demonstrating that muscular fibers, when separated from their nervous system, undergo permanent maximum shortening. This hypothesis is valuable in explaining the origin of stenosis in the digestive tract, both in sphincteral and in nonsphincteral areas.

Five roentgenograms; 1 photograph; 2 photomicrographs.

CAPT. NEIL E. CROW
Parks AFB, Calif.

The Persimmon Bezoar. Carl Davis, Jr., and Donald Tarun. Arch. Surg. **75:** 188–192, August 1957. (122 S. Michigan Ave., Chicago 3, Ill.)

Persimmon phytobezoars are compact putty-like masses, frequently multiple, usually found in the stomach. Their development is probably immediate following the ingestion of incompletely ripened persimmons. *In vitro* experiments have shown that gastric juice will precipitate a soluble substance, called shibuol, which is present in large quantities in the unripe persimmon. The bezoar is then formed by the aggregation of fragments of seed and skin.

Symptoms vary in character and severity. Gastric ulceration, probably due to trauma, is frequently associated. The foreign body may pass into the small intestine to produce an obstruction. There may be hemorrhage, and perforation may occur with a subsequent peritonitis.

The diagnosis may be made by fluoroscopic and roentgenographic means. A foreign body may be demonstrated in the stomach, floating on the barium mixture. When the bezoar is of sufficient size to fill the stomach, there may be some difficulty in differentiating it from a malignant neoplasm of the stomach. For this reason the authors warn against denying the patient with a roentgen diagnosis of extensive gastric carcinoma surgical exploration.

The case of a 49-year-old man is reported. He consumed a large quantity of persimmons and a few hours later experienced sharp abdominal pain. Roentgen examination disclosed an obstructing foreign body in the stomach. This was removed eight days after ingestion of the fruit and proved to be a typical bezoar. The immediate postoperative course was complicated by acute appendicitis.

One roentgenogram; 3 photographs.

JOHN F. RIESSER, M.D.
Springfield, Ohio

Intestinal Obstruction Simulated by Nonobstructing Intra-Abdominal Lesions. Report of Two Cases. Paul W. Braunstein. Arch. Surg. **74:** 624–630, April 1957. (525 E. 68th St., New York 21, N. Y.)

Two cases are reported illustrating a symptom complex compatible with intestinal obstruction without actual mechanical obstruction being present. The cases are similar in that both patients were over seventy, and the clinical history and physical findings were suggestive of intestinal obstruction. Roentgenographic studies in both cases indicated mechanical large bowel obstruction. Surgery, however, showed in one case an acutely inflamed gallbladder, and in the second "left renal infarction with thrombosis of the left renal artery."

These patients exhibited acute intra-abdominal disease close to the gastrointestinal tract so that an inflammatory process caused reflex segmental ileus and a clinical picture of intestinal obstruction.

A brief review of the literature is presented.

Four roentgenograms; 4 drawings.

J. E. RHODENBAUGH, M.D.
The Henry Ford Hospital

Regional Enteritis of the Duodenum. William C. McGarity. Surg., Gynec. & Obst. **105:** 203–209, August 1957. (Emory University School of Medicine, Emory University, Ga.)

Twenty-five previously reported cases of regional enteritis which involved the duodenum are reviewed and another case is described. In only 2 of the cases was the disease limited to the duodenum. The diagnosis may be suspected in patients with regional enteritis exhibiting symptoms referable to the upper intestinal tract. It should be remembered in the differential diagnosis of duodenal obstruction.

In the early stages of the disease roentgenograms may show only disturbed duodenal motility. Later, various deformities are present which may go on to obstruction. The normal mucosal patterns are disturbed or lost. Peristalsis is altered. There may be skip areas, with either abrupt or gradual transition between normal and abnormal segments. One or more areas of constriction, possibly with a "string sign," may be seen. Proximal dilatation of the duodenum and stomach depend on the amount of obstruction. The remainder of the intestinal tract should always be checked for disease. Interval studies may be required before the presence of organic disease is established with certainty.

The author reports the case of a 46-year-old woman on whom a colectomy and resection of the last 4 feet of ileum were performed for regional ileitis of some twenty years duration. Four months later she was readmitted to the hospital because of nausea, vomiting, weight loss and upper abdominal pain. Roentgenograms showed two constrictions in the second part of the duodenum, associated with moderate distention of the proximal duodenum and stomach. Repeat studies, nine months later, showed the constrictions to be worse, with almost complete obstruction. At operation a rubbery thickening was palpated in the second part of the duodenum, with almost complete constriction of the lumen at this point. Another constriction was found several centimeters distal to the first. There was scarring at the duodenal bulb, as with an old ulcer. The rest of the tract appeared free of disease. A diagnosis of regional enteritis of the duodenum was made, but the duodenum was not opened and no biopsy was taken. A gastrojejunostomy was done and the patient was free from intestinal discomfort two years later.

Five roentgenograms; 1 photograph; 1 table.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Examination of the Colon Using a Synthetic Purgative. Ferdinand A. Salzman and Robert E. Wise. Am. J. Digest. Dis. **2:** 420–429, August 1957. (Lahey Clinic, Boston, Mass.)

The authors report their experience with Win 9059 (dihydroxyphenylisatin), a compound related chemi-

cally to phenolphthalein. It remains unaltered in the stomach but in the alkaline medium of the intestine it loses its acetyl radicals and exerts its specific action on the colon. It is said not to be absorbed through the intestinal wall.

In clinical trial the compound was found to be free of toxicity but productive of cramping of varying degrees in a high percentage of cases. Faintness was also a subjective complication. No lasting deleterious effects upon the colon were found.

Evacuation of the colon is more complete than with tannic acid, and with the quantity of the compound used by the authors (40 mg. in 2 quarts of a barium water suspension), Win 9059 was frequently unsatisfactory for the routine barium enema examination because of the complete evacuation of the barium with resultant loss of mucosal pattern. This property, however, has been found to be advantageous in a cleansing enema prior to air-contrast examination, resulting in a high percentage of good and excellent studies of the colon.

Five roentgenograms; 2 tables.

THEODORE E. KEATS, M.D.
University of Missouri

Annular Pancreas. Thomas J. Whelan, Jr., and George B. Hamilton. Ann. Surg. **146:** 252–262, August 1957. (Valley Forge Army Hospital, Phoenixville, Penna.)

The authors report three cases of annular pancreas and analyze all reported cases in regard to complications, associated anomalies, and operative procedures.

Associated congenital anomalies are recorded in 70 per cent of the cases in children. Eight of 56 adult cases (14 per cent) had other anomalies. Of particular interest is the occurrence of duodenal stenosis and atresia in 43 per cent of the children and stenosis in 12 per cent of the adults. The remainder of the anomalies, for the most part, are associated with faulty development of the gastrointestinal tract.

There are four major complications which may occur. (1) Duodenal obstruction was the most frequent presenting complication. (2) Stasis, predisposing to peptic ulceration, was present in 32 per cent of the cases and (3) pancreatitis associated with secondary changes in the annulus in 16 per cent. (4) Secondary involvement of the biliary tract with obstruction and jaundice has been reported three times.

The condition may be asymptomatic. Otherwise there are two clinical types: (1) acute and high-grade duodenal obstruction, and (2) chronic and low-grade duodenal obstruction. The former is the common type in children. X-ray findings depend on the degree of obstruction, but usually the stomach and duodenum are greatly dilated, causing the "double-bubble" sign. In adults, the pattern of chronic duodenal obstruction is seen most often. Here diagnosis is dependent exclusively upon the findings on a gastrointestinal series. Typically, there are dilatation of the first portion of the duodenum, and narrowing of the second portion. The length of narrowed segment varies and the mucosa is not distorted. Occasionally a smooth dextral filling defect is seen. Cicatrization from ulceration may prevent dilatation of the first portion of the duodenum.

Surgical treatment is discussed and standard procedures are recommended according to the complications.

Five roentgenograms; 3 photographs; 2 tables.

CAPT. BYRON G. BROGDON
Parks AFB, Calif.

The Radiological Diagnosis of Papillomatous Cholesterosis of the Gall Bladder. Eric Samuel and Cecil Komins. Brit. J. Radiol. **30:** 356–360, July 1957. (Johannesburg, Union of South Africa)

Cholesterosis of the gallbladder occurs in a diffuse and localized form. In the diffuse form, the so-called "strawberry gallbladder," the mucous membrane is usually congested, reddened, and covered with small yellowish lipoid deposits. In the localized form the lipoid deposit is heaped up to produce a papillomatous outgrowth.

In the diffuse form of cholesterosis interference with function is minimal and the specificity of the diagnosis is low. Papillomatous cholesterosis, on the other hand, may produce significant roentgen changes. Single or multiple filling defects are seen to arise from the wall of the gallbladder and are constant in position when viewed in upright and decubitus studies, a feature which serves for differentiation from nonopaque stones. Discrete gas shadows occasionally may mimic a cholesterosis and may be sufficiently troublesome at times to require tomography. Differentiation from simple papillomata and adenoma of the gallbladder can be made only by histologic examination. Simple papillomata, however, are extremely rare. Occasionally a small congenital fold in the fundus may mimic a papillomatous cholesterosis, but careful filming, particularly in the erect position, with compression, usually permits a distinction.

Six cases of papillomatous cholesterosis are reported. Symptoms varied from relatively severe episodes of cholecystitis to mild discomfort and indigestion.

Fourteen roentgenograms; 1 photomicrograph; 2 photographs.

J. A. GUNN, M.D.
Grand Rapids, Mich.

Effect of Peritonitis of Nonbiliary Origin on the Function of the Gall Bladder as Measured by Cholecystography, Its Frequency and Its Duration. Rafael Sanchez-Ubeda, Francis F. Ruzicka, and Louis M. Rousselot. New England J. Med. **257:** 389–394, Aug. 29, 1957. (F. F. R., St. Vincent's Hospital, New York 11, N. Y.)

It has long been known that following an attack of acute pancreatitis a normal gallbladder may not function for a period of time. This report is the result of observations on the effect of other causes of peritonitis on gallbladder function. The patients selected all had normal gallbladders as demonstrated by cholecystography.

The patients were divided into four groups. In the first group of 21 patients, with inflammatory peritonitis demonstrated at surgery, 15 showed disturbance of gallbladder function as indicated by nonvisualization or poor visualization lasting for a period of three days to three months. In a second group of 20 patients with postoperative ileus, 16 showed disturbed gallbladder function for from five to ninety days. In a third group, with active duodenal ulcer and signs of peritoneal irritation but without frank perforation, all of 8 showed disturbed function. In a control group of 6 patients undergoing general anesthesia and operation not involving the abdominal cavity, 2 showed poor function.

The function of the normal gallbladder can be seriously affected by peritonitis or peritoneal irritation. The proximity of the gallbladder, as well as the severity of the process, seems to determine the degree of this effect. Disturbances are more severe in older patients.

It is suggested that other factors than involvement by contiguous inflammation may operate in producing a temporarily nonfunctioning gallbladder in such cases as have been described. The possibility that abeyance of function may be a local manifestation of the systemic response to the alarm reaction is raised. The hypothesis that the explanation lies in poor absorption of the opaque material from the intestinal tract was not borne out by cholecystography. Still another hypothesis is that of stagnation of the bile in the gallbladder, with failure of emptying before administration of the opaque material. This is felt not to be a major factor because of the lengthy period of inhibition in some patients. The possibility that all of the patients with peritonitis and ileus had a degree of pancreatitis to explain the impaired gallbladder function is vitiated by the absence of elevation of the serum amylase in any of these cases.

The authors conclude that, since the gallbladder is affected by nonspecific forms of peritoneal irritation, it is important not to incriminate it in an attack of acute pancreatitis on the basis of a single examination revealing nonfunction. Rather a prolonged period of observation, with repeated cholecystograms, should be carried out before making such a diagnosis.

Five tables. RICHARD G. LESTER, M.D.
University of Minnesota

Oral Cholangiography. Preliminary Report. Michael J. Stamatakos and Kenneth W. Taber. J.A.M.A. **164:** 1752–1755, Aug. 17, 1957. (K. W. T., 421 Chew St., Allentown, Penna.)

The authors report a method of oral cholangiography by which the biliary ducts are visualized in the presence of a nonfunctioning gallbladder. The only patients included in their study were those whose gallbladders were known to be present but could not be visualized even with "reinforcement," *i.e.*, administration of iopanoic acid (Telepaque) a second time, twelve hours after the first examination, with the patient remaining on a fat-free diet.

Forty-eight (71.4 per cent) of 67 patients in whom the gallbladder was not visualized showed Telepaque in the common bile duct. In 19 patients (28.6 per cent) neither the gallbladder nor the common duct was visualized, but in only 4 of these 19 patients was this nonvisualization not explained by clinical evidence of liver or common duct disease. One patient had complete pyloric obstruction.

The authors conclude that, "with a careful examination, the common duct can be visualized in patients with gallbladder disease provided they do not have malfunctioning livers or common bile ducts." It is suggested that the hepatic and common bile ducts may take over the concentrating function of the gallbladder when that organ is not functioning.

Ten roentgenograms.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

THE MUSCULOSKELETAL SYSTEM

The Arteriographic Picture of Benign Bone Lesions Containing Giant Cells. Robert Schobinger and Henry C. Stoll. J. Bone & Joint Surg. **39-A:** 953–960, July 1957. (H. C. S., Roswell Park Memorial Institute, Buffalo 3, N. Y.)

The characteristic changes demonstrated in and about malignant bone tumors or soft-tissue neoplasms on peripheral arteriography are: increased irrigation of the area by newly formed vessels; early venous return of the contrast medium, suggesting some type of arteriovenous shunt; deviation and tortuosity of the arteries feeding the tumor; a peculiar striation effect which in many instances is observed before conventional films reveal a definite neoplasm; puddling and retention of the opaque material in the area over a prolonged period of time. On the other hand, most benign bone tumors show no abnormal vascular pattern on arteriograms.

Three cases of verified benign lesions of bone containing giant cells which demonstrated prolonged puddling and retention of contrast medium in the venous phase are presented; no other arteriographic change was seen. In each instance, twelve roentgenograms were exposed at one-second intervals, starting after completion of the injection of 50 per cent Urokon. The cases included (*a*) a benign giant-cell tumor of the first cuneiform bone in the foot of a twelve-year-old girl, (*b*) an area of osteitis fibrosa cystica in the tibia of a man with known hyperparathyroidism, and (*c*) an aneurysmal bone cyst in the proximal tibia of a fifteen-year-old youth. It is interesting that the observed intensity and length of retention in the venous phase bore no correlation with the vascularity of the lesion. The authors emphasize the fact that no other criteria of malignancy were seen in the vascular pattern of these benign lesions, but they feel that arteriography does not as yet point to the exact histologic nature of bone and soft-tissue tumors.

Eleven roentgenograms; 4 photomicrographs.

LAWRENCE A. POST, M.D.
University of California, S. F.

Salmonella Osteomyelitis in Patients with Sickle-Cell Anemia. E. W. Hook, C. G. Campbell, H. S. Weens, and G. R. Cooper. New England J. Med. **257:** 403–407, Aug. 29, 1957. (E. W. H., Johns Hopkins University School of Medicine, Baltimore, Md.)

The authors report 3 cases of Salmonella osteomyelitis and an additional case of Salmonella bacteremia encountered in a series of 36 consecutive patients with sickle-cell anemia. All of the patients were Negro males, ranging in age from 15 months to 23 years. Twenty-nine such cases, including 1 without bone involvement, have been reported previously. These are summarized in tabular form.

The manifestations of Salmonella osteomyelitis are said to be indistinguishable from those of other pyogenic forms of osteomyelitis. In addition, the differentiation from bone infarction may be difficult, especially in small children, where soft-tissue swelling, periosteal reaction, and cortical destruction can occur with infarction. A definitive diagnosis depends upon a correlation of the roentgen findings with the other clinical and laboratory studies, and in some cases on aspiration of the involved bone.

The most satisfactory therapeutic regimen is a combination of chloramphenicol with surgical drainage. It should be noted that the response has not been dramatic in these patients. The possibility of a recurrence months or even years after apparent healing must be kept in mind.

The possible factors causing the increased susceptibility to Salmonella osteomyelitis in sickle-cell anemia include capillary thromboses in the gastrointestinal tract, which is thus less resistant to invasion than normal; generalized debility and autosplenectomy with

consequent decreased resistance to infection; ischemia in a local area of bone, resulting in decreased resistance. A sickle-cell crisis frequently precedes the initial manifestation of osteomyelitis.

Five roentgenograms; 1 table.

RICHARD G. LESTER, M.D.
University of Minnesota

Aneurysmal Bone Cyst. Observations on Fifty Cases. Louis Lichtenstein. J. Bone & Joint Surg. **39-A:** 873–882, July 1957. (Wadsworth Hospital, Los Angeles 25, Calif.)

The author presents observations based on some 50 cases of aneurysmal bone cyst seen since 1948, 33 of which have not been previously reported. He believes that the lesion results from some persistent local alteration in hemodynamics, which leads to increased venous pressure and the development of a dilated and engorged vascular bed within the bone. Theories that regard the condition as an atypical giant-cell tumor or unusual hemangioma or hemorrhage are rejected. The affected site ultimately resembles an expanded blood-filled sponge, with fibro-osseous septa, areas of calcifying new bone, and sometimes a prominent giant-cell reaction to extravasated blood. On the roentgenogram the lesion presents as a cystic expansion of bone, often eccentrically placed.

Aneurysmal cysts have been seen in almost every bone of the skeleton, but are most common in the long limb bones and the vertebral column; these sites accounted for 60 per cent of the cases in the author's series. About two-thirds of the patients were children or adolescents. There is probably no sex predilection. Prompt treatment is emphasized, since these cysts may become extremely large, sometimes requiring amputation of a limb or, in the case of vertebral involvement, resulting in collapse or paraplegia. Curettement and packing with bone chips may be the treatment of choice with fairly small lesions in accessible sites. Supplementary roentgen therapy may be used if complete removal is not possible. Deep-seated or vertebral cysts can be controlled by moderate irradiation; doses over 2,000 r should be avoided because of the danger of the development of late sarcoma following heavy irradiation.

Twenty-four roentgenograms; 3 photographs; 1 photomicrograph.

LAWRENCE A. POST, M.D.
University of California, S. F.

Multifocal Osteogenic Sarcoma. Report of a Case. C. H. G. Price and D. E. Truscott. J. Bone & Joint Surg. **39-B:** 524–533, August 1957. (C.H.G.P., Pathology Research Laboratory, University of Bristol, Bristol 1, England)

Except for cases associated with Paget's disease, multiple osteogenic sarcomas are rare tumors of the skeleton.

The authors' patient, a fifty-year-old woman, gave a history of pain in the right knee of five to six months duration, low back pain, and a mass over the sternum, increasing in size. Roentgen examination showed involvement of the skull, sternum, right humerus and scapula, right first rib, most of the vertebrae, pelvis, and femora. All of the involved bones showed marked increase in density, with the lesions of the skull and femora fairly well demarcated, and the sternum greatly expanded in diameter. The sacrum was extensively involved and the anatomical form of the pelvis was distorted, the individual bones being thickened by numerous dense, confluent masses showing a spicular, calcified structure. The remaining bones were normal except for osteoporosis of the long bones.

Multiple injections of P^{32}, for a total of 85 μc, over a three-month period, were followed by subjective and objective improvement, but approximately five weeks after the last injection the patient became profoundly anemic, with mucosal bleeding, and died in coma.

The gross and microscopic results of postmortem study appeared to favor multiple primary tumors. The histologic diagnosis was low-grade osteoblastic osteogenic sarcoma. Such tumors are slow-growing in nature, without early pulmonary metastases. A possibility advanced by the authors is that the sarcoma developed simultaneously at several points in a widespread osteoblastic bone dystrophy. Although the multifocal nature of about a fifth of all bone sarcomas complicating Paget's disease is well recognized, no evidence of Paget's disease was found in this case.

Six roentgenograms; 7 photomicrographs; 1 graph; 1 table.

FRANK T. MORAN, M.D.
Auburn, N. Y.

Spondylolisthesis Without Spondylolysis. Degenerative Changes in the Apophyseal Joints Associated with Subluxation in the Lumbar Spine. Steven E. Ross and William L. Caldwell. Stanford M. Bull. **15:** 219–223, August 1957. (Stanford University School of Medicine, San Francisco 15, Calif.)

Anterior subluxation of a lumbar vertebra with an intact neural arch is not uncommon in elderly people. The authors report a series of 13 cases in patients aged fifty-five to seventy-four years. In each instance oblique views confirmed the integrity of the neural arch. No consistent pattern of symptoms and signs was found. In all cases the fourth lumbar vertebra was displaced anteriorly and there was associated degenerative change in the apophyseal joints at the same level. Six patients showed some narrowing of the disk space in the affected segment, but in most instances this was minimal. The lumbar curve was not altered, though in some cases there appeared to be a slight exaggeration of lumbar lordosis.

It is felt that degenerative disease of the apophyseal joints is sufficient to explain the anterior subluxation. Although 1 of the 2 cases illustrated shows a variation in the plane of the facets at the involved level, the possible contributory role of such a change is discounted.

Four roentgenograms, 2 tables.

LAWRENCE A. POST, M.D.
University of California, S. F.

The Covertebral Articulations and Cervical Foramen Encroachment. Lee A. Hadley. J. Bone & Joint Surg. **39-A:** 910–920, July 1957. (925 State Tower Bldg., Syracuse, N. Y.)

The covertebral joints, formed by bony projections which extend upward from the lateral margins of the vertebral body to articulate with the body above, are situated posterolaterally between the lowermost five cervical vertebrae. They are also termed uncovertebral, neurocentral, and Luschka joints. Degenerative thinning of the intervertebral disk results in covertebral osteophytes, which can impinge either on the vertebral artery and its surrounding sympathetic plexus or more posteriorly upon the intervertebral foramen.

For diagnosis of covertebral osteophytes roentgeno-

grams should be obtained in three planes. In the postero-anterior view, with the patient face down on the Bucky table and the forehead supported by a small sandbag, all the cervical disks and covertebral articulations can be visualized. In the lateral roentgenogram, advanced covertebral spurs may be seen as lines crossing the vertebral body in the anteroposterior direction. In this view one may also visualize a backward projection of posterolateral spurs, simulating the appearance of a disk bulging posteriorly. In the 45° oblique view, encroachment upon the intervertebral foramina is demonstrable both anteromedially by vertebral body marginal spurs and posterolaterally by spur formation from the superior bony margins of the posterior articulations. Also, when backward displacement of a vertebra has occurred, the superior articular process of the body below it may be seen impinging on the foramen.

Several excellent photomicrographs showing the histologic changes which occur in the nerve roots with intervertebral foramen encroachment are reproduced. One, in particular, shows that thickened ligaments and fibrocartilage may cause the foramen to be much smaller than it appears roentgenographically.

Bony encroachment upon the intervertebral foramen may occur without symptoms, or symptoms of root pressure may be present without roentgen evidence of foramen encroachment; other factors, such as edema, congestion, and fibrosis, may be partly responsible.

Fifteen roentgenograms; 5 photomicrographs; 4 photographs

LAWRENCE A. POST, M.D.
University of California, S. F.

Intervertebral-Disc Degeneration Considered as a Pressure Atrophy. K. Lindblom. J. Bone & Joint Surg. **39-A:** 933–945, July 1957. (Karolinska Sjukhuset, Stockholm 60, Sweden)

The fact that disk degeneration and rupture may occur long before adult age indicates that the process of aging is only partly responsible. Trauma is a factor, and the author believes that pressure is still another.

Rats' tails were tied up and fixed in the shape of a U for varying periods. It was found that degeneration and even rupture occurred on the concave side of the tails while the convex side remained normal. This effect is regarded as a pressure atrophy. The same principle is operative in man. On dissection of 20 human thoracic spines radial fissures and ruptures were seen in 81 disks; of these, 43 per cent were in a frontal or lateral direction, in contrast to the marked preponderance of posterior ruptures found at the cervical and lower lumbar levels in earlier studies.

The effect of high heels on the lumbar curve was studied. In 30 adults examined with and without a support of 6 cm. under the heels, the support increased the lumbar lordosis in 23, and anterior tilting of the pelvis was seen in 10 cases. This forced angulation produces increased pressure on the posterior portion of the lumbosacral disk. On review of a large series of myelograms of both men and women, herniation of the lumbosacral disk was found to be 12 per cent higher in women, whereas the fourth lumbar disk was involved more often in men. Over 400 lumbar spines of primitive or prehistoric people were also examined, and here disk degeneration was more equally distributed at all levels, again testifying to the effect of modern living and high heels on the production of lower lumbar disk degeneration as a result of pressure atrophy.

Four roentgenograms; 13 photomicrographs; 6 charts and tables.

LAWRENCE A. POST, M.D.
University of California, S. F.

Dissecting Disc Herniation in a 4-Year-Old Child. K. Ekengren and K. Lindblom. Acta radiol. **48:** 156–158, August 1957. (Karolinska Sjukhuset, Stockholm 60, Sweden)

The authors' patient was a child born with anal atresia and a wedged deformity of the tenth thoracic vertebra. When she was four years of age, a small fragment of the anterior superior margin of the fourth lumbar vertebra was found to be separated and the adjacent interspace narrowed. During the following years, up to the age of eight, this separation grew more pronounced and the narrowing of the interspace increased. The lateral radiograph is strongly suggestive of juvenile epiphysitis, but the involvement is limited to the anterosuperior aspect of the vertebral body and, on oblique views, the remaining portion of the vertebral body is normal. The authors state that the entire course observed in the lumbar vertebra was similar to that of a dissecting transosseous rupture of the intervertebral disk.

A brief discussion of the developmental anatomy in this area and the theories as to the cause of disk protrusion is presented.

Five roentgenograms.

CAPT. NEIL E. CROW
Parks AFB, Calif.

Calcification of the Intervertebral Disks in Childhood and the Problem of Calcification in General. Kurt Scheyer. Radiol. clin. **26:** 198–208, July 1957. (In German) (7, Hebron St., Ramat-Gan-B, Israel)

The author reports the case of a 6- year-old girl with increasing backache of two weeks duration, with no antecedent history of trauma. The neck and spine were stiff, and tenderness to pressure and percussion was noted in the T-4 to T-6 area. There was no fever; laboratory studies were negative. On x-ray examination, calcifications were noted in the nucleus pulposus of the intervertebral disk between T-6 and T-7. Symptoms improved on bed rest, and the child was well after two and a half weeks. Though the clinical improvement was maintained, a follow-up examination three years later showed no change in the radiologic findings.

Twenty-one similar cases from the literature are reviewed. In somewhat less than 50 per cent, calcification was an incidental finding on examination for other causes. The author emphasizes the importance of differentiating such calcification from ossification following traumatic periosteal avulsion, as in Pellegrini-Stieda disease. It is suggested that the calcification in intervertebral disks falls into the classification of calcinosis circumscripta, which takes place in tissues of "low physiologic vitality," such as tendons and hyaline tissue and/or tissues of which the blood supply is pathologically or mechanically impaired or suspended. It is possible that microtrauma due to ordinary activities, such as games and gymnastics, may impair the blood supply to this rather avascular area and produce venous obstruction so that calcium could come into the area in adequate amounts to be deposited.

The relationship of intervertebral disk calcification to the presence of symptoms is likened to tendinitis cal-

carea in adults: repeated trauma leads to calcification and symptoms are called forth when infection or other cause leads to local swelling in calcified areas.

Three roentgenograms; 1 table.

FREDERIC N. SILVERMAN, M.D.
Children's Hospital, Cincinnati, Ohio

Calcified Disc Protrusion in Children. I. Bjelkhagen and H. Gladnikoff. Acta radiol. **48:** 151–155, August 1957. (Samariten Hospital for Children, Stockholm, Sweden)

Twenty-three examples of calcification of the nucleus pulposus in children have previously been described. The authors report 3 cases and analyze all the recorded cases with respect to their sites in the spine, age, sex distribution, duration, and prognosis.

Generally, the calcifications are situated in the posterior part of the disk but they may occasionally appear anteriorly. They are practically always in the midline but at times may involve almost the entire disk. In about two-thirds of the 26 cases, impressions of the calcifications and surrounding cartilage were visible in adjacent parts of the vertebral bodies.

Calcification in children does not occur at the sites of disk degeneration and protrusion common in adults; no examples caudal to L-2 have been encountered. The etiology is unknown. The sex distribution is almost even. The lesions are usually temporary and generally disappear within a year.

In 5 of the 26 children calcifications were secondary findings, but the remaining cases were symptomatic, with pain, impaired motility, and eventually fever. Treatment is symptomatic and prognosis is excellent.

Six roentgenograms; 2 diagrams.

CAPT. BYRON G. BROGDON
Parks AFB, Calif.

Demonstration of Fracture-Dislocations of the Temporomandibular Joint Area by Laminagraphy. William L. Caldwell, Klaus R. Dehlinger, Donald R. Walker, and Donald E. Kennedy. Stanford M. Bull. **15:** 174–182, August 1957. (Herrick Memorial Hospital, Berkeley, Calif.)

The temporomandibular joint is a hinge-sliding joint which is divided into two separate joint spaces by a biconcave fibrocartilaginous meniscus. The mouth is closed by the powerful, carefully balanced masseter, temporalis, and internal pterygoid muscles. The jaw is opened by its own weight plus the pull of the external pterygoid and suprahyoid muscles. Unilateral contractions of the pterygoid muscles produce a lateral shift of the mandible. These important jaw movements must be preserved following trauma.

Roughly, 60 to 65 per cent of mandibular fractures are subcondylar, either alone or in association with other fractures. The condylar area is difficult to demonstrate on plain films, but laminagraphy is uniformly successful.

The routine mandible examination includes a postero-anterior film, right and left oblique views of the body, and lateral laminagrams of the condylar region. Anteroposterior laminagrams are obtained in cases which show a fracture on the routine films. The lateral laminagram is taken with the patient's cheek and angle of the jaw resting on the table top; his temple must be above this level in order to keep the condylar process and ramus parallel and close to the film. The midplane of the joint in this position is 1.5 to 2.0 cm. above the table. For anteroposterior laminagrams, the head is held with the neck in a neutral position; the temporomandibular joint, which is consistently 1 cm. anterior to the external auditory canal, usually lies 9 to 11 cm. above the table. Four cases of condylar fractures are discussed and illustrated.

Seven roentgenograms.

LAWRENCE A. POST, M.D.
University of California, S. F.

Osteochondroma of the Coronoid Process of the Mandible. Report of a Case and Review of the Literature. Morris H. Levine, James Chessen, and William D. McCarthy. New England J. Med. **257:** 374–376, Aug. 22, 1957. (M. H. L., General Rose Memorial Hospital, Denver, Colo.)

Osteochondroma of the coronoid process of the mandible is rare, only 4 cases having been previously reported. The authors add the case of a 73-year-old female, who had a mass on the left side of her face that had been increasing in size for over thirty years. There was progressively increased limitation of jaw motion, but at no time were there pain or any associated symptoms. X-ray examination, including tomograms, showed a large, bulbous, boot-shaped osteochondroma of the coronoid process of the mandible expanded to fill the ring formed by the left zygomatic arch and cranium, with erosion of the anterior portion of the zygomatic ring. There was no motion at the temporomandibular joint.

The previously reported cases occurred in a 15-year-old boy with a seven-year history of an enlarging mass, with increasing limitation of motion of the mandible; in a 19-year-old youth; in a 34-year-old woman with progressive symptoms for two years; in a 24-year-old male with at least four years of increasing symptoms.

This condition is readily corrected by surgical removal of the osteochondroma, together with a part of the zygomatic arch. Without surgery, a bad dental condition may develop, consequent to progressive lack of stimulation of periodontal bone normally occurring during mastication.

One roentgenogram; 2 photographs.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Retrosternal Dislocation of the Clavicle. Allen M. Ferry, Frederick W. Rook, and James H. Masterson. J. Bone & Joint Surg. **39-A:** 905–910, July 1957. (915 19th St., N. W., Washington 6, D. C.)

Six cases of retrosternal dislocation of the clavicle are reported. These were all due to an indirect force exerted downward and forward on the posterolateral aspect of the shoulder, though a direct force can produce a similar result. Roentgenograms of the affected sternoclavicular joint reveal medial and inferior displacement of the clavicle, an important but not a diagnostic sign. In the more common anterior dislocation, the sternal end of the clavicle is usually displaced medially and upward.

All patients complain of a deep boring pain in the region of the joint and maintain a characteristic protective position with the head and shoulder held forward. If the posterior displacement is great enough, there will be symptoms due to pressure on the trachea or esophagus. Other possible complications include

laceration of the great vessels in the superior mediastinum, injury to the brachial plexus, and subcutaneous emphysema. If the patient is seen before edema develops, absence of the normal clavicular prominence is a fairly reliable sign.

The authors' patients were seen early, and responded well to closed reduction. In most of the previously reported cases, delay has necessitated the use of some type of open reduction and internal fixation.

Six roentgenograms. LAWRENCE A. POST, M.D.
University of California, S. F.

Congenital Deformity of the Carpus Associated with Maldevelopment of Certain Thenar Muscles. T. Hanley and P. C. Conlon. J. Bone & Joint Surg. **39-B:** 458–462, August 1957. (T. H., Royal Hospital, Sheffield 1, England)

Two cases of multiple congenital anomalies are described. Although one patient had bilateral cervical ribs and the other a spina bifida of the first thoracic vertebra, the authors' interest is primarily in the abnormalities of the carpal bones and thenar muscles.

Both patients were admitted to the hospital for unrelated causes. On physical examination the first patient was found to have diminished arterial pulsation at the wrists, while both hands had a characteristic simian appearance. There was marked radial deviation of both wrists, but with a normal range of motion. The hypothenar muscles were present but underdeveloped. Radiological examination of the left hand showed the scaphoid to be much smaller than normal, with the bone density slightly increased. A wide space separated the scaphoid from the capitate and trapezium. The styloid process of the radius was poorly developed, and the lower end of the radius was at right angles to the shaft, with the ulnar and radial styloid at the same level. Other changes were found in the first metacarpal and metacarpal-phalangeal joints. On the right side no separate scaphoid was identified and there was fusion of the capitate and hamate bones.

In the second patient both thenar eminences were absent. Radiological study showed the left scaphoid to be small and elliptical, lying transversely. Its nonradial aspect was widely separated from the capitate and trapezium. An intravenous pyelogram showed crossed renal ectopia.

Neither patient suffered disability from the muscular lesions. It cannot be said with certainty whether the affected muscles were wasted, congenitally absent, or maldeveloped.

Four roentgenograms; 1 photograph; 1 diagram.
FRANK T. MORAN, M.D.
Auburn, N. Y.

Sepsis in Normal and Premature Infants with Localization in the Hip Joint. Philip J. Howard. Pediatrics **20:** 279–289, August 1957. (The Henry Ford Hospital, Detroit 2, Mich.)

Septic infection of the hip joint is a somewhat uncommon condition in newborn infants. When it does develop, however, it is a severe, crippling process, very difficult to detect, yet demanding early vigorous treatment if the joint is to be saved.

Newborn, especially premature, infants often fail to exhibit fever and may continue to gain weight in the presence of septicemia. Therefore, damaging lesions may develop undiagnosed until irreparable injury has occurred. For these reasons, regional swelling of the upper portion of the thigh is felt to be an urgent indication for diagnostic needle puncture of the hip joint.

Early roentgenograms may assist in making the diagnosis. Simple increase in width of the hip joint space, upward and lateral displacement of the femoral head, and the obturator sign are described as indicating hip joint pyarthrosis.

The author presents 5 cases, with early and late follow-up roentgenograms to point up his comments and conclusions. In 3 patients, the femoral head in the involved joint was destroyed by the infection, although this did not become apparent until skeletal growth and development had progressed well beyond the neonatal period. In differential diagnosis one should consider cellulitis, fracture, septic arthritis with abscess formation, poliomyelitis, tumor, and osteomyelitis of the femur.

The hazard of needle aspiration of the hip joint is slight and evidently far preferable to the severe consequences of a missed diagnosis.

Sixteen roentgenograms; 1 table.
DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Impingement Exostoses of the Talus and Tibia. Don H. O'Donoghue. J. Bone & Joint Surg. **39-A:** 835–852, July 1957. (1111 N. Lee St., Oklahoma City 3, Okla.)

The author has found the development of exostoses just above the anterior lip of the distal tibia and on the apposing area on top of the neck of the talus to be of relatively frequent occurrence in athletes and others with a history of repeated dorsiflexion of the ankle. Eleven cases are presented.

Normally, the anterior lip of the tibia inclines backward in order to prevent impingement against the talus during extreme dorsiflexion. There is no ligamentous attachment at these locations. The joint capsule attaches higher on the tibia and runs forward to the navicular with no attachment to the superior surface of the talar neck. Spur formation in this region is therefore not related to ligamentous injury. It is the result of direct trauma during forcible dorsiflexion. The injury occurs, not during ordinary running, but during the "drive" of the athlete when his cleats are fixed to the ground with the foot forcibly dorsiflexed. Characteristically, the player loses his "drive" and, since ordinary examination reveals no swelling, pain on inversion or eversion, or tenderness, the impression grows that he is "dogging it." He usually presents himself with aching pain in the ankle, sharply increased by "driving." Examination almost uniformly elicits pain on forcible dorsiflexion of the foot and the diagnosis is confirmed by roentgenograms. These show that the anterior margin of the lower end of the tibia has lost its rounded character and that the edge is sharp, often with an identifiable spur extending forward over the articular surface of the talus. In addition an exostosis of greater or less size may appear on top of the neck of the talus. Upon dorsiflexion of the foot the two will be seen to impinge.

Seven athletes were treated by surgical removal of the spurs on one or both ankles, with good to excellent functional results; most of these men were professional football players. Almost all gave a history of a specific injury.

In order to determine whether these exostoses are more frequent (even though nonsymptomatic) in ath-

letes, survey lateral roentgenograms were made of 120 ankles of student athletes and 120 ankles of student nonathletes: only 55 per cent of the athletes had no spurs, as compared to 84 per cent of the control group. In many instances exostoses were seen on only one bone, either the tibia or talus.

Twenty-six roentgenograms; 2 photographs; 4 tables.

LAWRENCE A. POST, M.D.
University of California, S. F.

Ossification of the Calcaneal Apophysis in Healthy Children. Some Normal Radiographic Features. Steven E. Ross and John Caffey. Stanford M. Bull. **15:** 224–226, August 1957. (S. E. R., Stanford University School of Medicine, San Francisco 15, Calif.)

A study of roentgenograms of both feet of 292 asymptomatic white children between the ages of three and twelve years led the authors to the following conclusions: Ossification of the calcaneal apophysis starts between the ages of four and six years in girls, and four and nine years in boys. In the majority of children, the degree of ossification is bilaterally symmetrical; fusion of the apophysis with the calcaneus does not usually occur before the age of twelve years. Increased radiographic density of the apophysis is a normal feature, and fissuring is seen in most healthy children.

The authors also reviewed the roentgenograms of 53 children complaining of pain in one or both heels. In all cases the radiographic features were identical with those seen in the series of normal cases.

One roentgenogram; 1 table.

LAWRENCE A. POST, M.D.
University of California, S. F.

Ainhum. G. Auckland, J. Ball, and D. Ll. Griffiths. J. Bone & Joint Surg. **39-B:** 513–519, August 1957. (G. A., 14 St. John St., Manchester 3, England)

The disease known as ainhum is restricted almost exclusively to male Negroes. It is characterized by a constricting sulcus appearing around the base of one fifth toe, and later around that of the other. The sulcus deepens, the toe becomes progressively externally rotated, and its connection with the foot increasingly slender. If not amputated, it eventually drops off. The condition is not rare in tropical areas, but the case presented here is only the second to be reported in the British Isles.

The patient was a West African Negro, who visited Britain as a merchant seaman and later settled there (1947). In 1954 he noticed a shallow, linear groove on the dorsal surface of the base of the fifth right toe and shortly afterward of the left fifth toe. The groove on the right side became progressively deeper and mildly inflamed, encircling the toe at the level of the proximal end of the middle phalanx.

Roentgenograms showed erosion of the head of the proximal phalanx, with almost complete severance of the toe. On the left side, which was less severely involved, the bony outlines were normal. The right fifth toe was amputated through the metatarsophalangeal joint, but treatment on the left was refused.

Histologic sections revealed an edematous deep subcutaneous layer, deficient in fat and infiltrated with plasma cells and lymphocytes. Both interphalangeal joints, and to a lesser extent the metatarsophalangeal joint, were involved in a chronic inflammatory process.

Review of the literature indicates some confusion as to the exact nature of the disease. According to the evidence in their case, the authors feel that the primary lesion is a chronic, nonspecific, concentric inflammation of the deep fascial layers and of the peritendinous structures of the toes. They believe it likely that the clinical features depend on the "curious anatomy of the inflammation" rather than upon any unique etiologic agent.

Four roentgenograms; 4 photographs; 3 photomicrographs.

FRANK T. MORAN, M.D.
Auburn, N. Y.

Femoral Growth after Occlusion of the Principal Nutrient Canal in Day-Old Rabbits. M. Brookes. J. Bone & Joint Surg. **39-B:** 563–571, August 1957. (Department of Anatomy, University of Liverpool, Liverpool, England)

Day-old rabbits were anesthetized and an incision was made on the medial side of the thigh from the inguinal groove to just above the medial femoral condyle. The principal nutrient artery of the femur was identified and followed in the interval between the vastus medialis and adductor group of muscles distally, to its entry into the principal nutrient canal. The periosteum and diaphyseal surface in the region of the canal were curetted and the scrapings were packed into it. Subsequent bone production by the fragments caused complete bony occlusion of the canal, as demonstrated at necropsy. Femur length was determined indirectly, 30, 75, 90, 120, and 150 days after the operation, from radiographs of the hind limbs.

One hundred and fifty days after operation the animals were killed. The arteries of the hind limbs were injected with a barium sulfate suspension and radiographed, and the femora were cleaned and measured directly. It was found that a significant deficiency in length, of the order of 3 per cent, occurs only during the initial and final phases of growth. In the intermediate phase—seventy-five to ninety days—there was no significant difference in length between occluded and control femora.

Occlusion of the nutrient canal may result in diversion of blood into the epiphyseal and metaphyseal arteries. It is probable that, while a collateral circulation is developing in the bone extremities, there is a diminution in the femoral blood supply and that to the growth cartilages, accounting for the growth lag of the occluded femora in the first thirty days. With the establishment of a collateral circulation by means of anastomoses between the metaphyseal arteries and the principal nutrient artery, the blood flow near the growth cartilages is increased, bringing about equalization in length of occluded and normal femora in the intermediate growth phase. Retardation of growth in the final phase is not adequately explained.

Four arteriograms; 1 graph; 2 tables.

FRANK T. MORAN, M.D.
Auburn, N. Y.

GYNECOLOGY AND OBSTETRICS

Placentography in Management of Placenta Praevia. H. B. Watson, M. Israelski, and W. M. Jordan. Brit. M. J. **2:** 490–494, Aug. 31, 1957. (Solihull Hospital, Birmingham, England)

Postural and soft-tissue placentography has proved a reliable and convenient method of determining the site of the placenta in utero, helping considerably to lessen the maternal and fetal hazards associated with

placenta praevia. The authors use low kilovoltages combined with high speeds of exposure, together with a broad abdominal compression band to reduce the size of the abdomen and obtain adequate immobilization of mother and fetus. No special x-ray apparatus is required, and the wedge-shaped aluminum filter devised by Reid is not used. The examination is performed at any stage after the thirty-second week of pregnancy, and the patient needs no preparation except for emptying her bladder. Three routine films are exposed: recumbent anteroposterior, erect lateral, and recumbent soft-tissue lateral.

The placenta is directly visualized as a soft-tissue shadow, or its position may be inferred by the position of the presenting part, under the effect of gravity, in relationship to the pelvic brim. Calcification may be demonstrated in the placenta. The authors found this to occur in 40 per cent of cases.

The primary indication for the performance of placentography is the clinical suspicion of the presence of placenta praevia. This may be aroused by antepartum hemorrhage. Of 6 patients with antepartum hemorrhage without other complications, 2 showed placenta praevia. Among 16 cases of antepartum hemorrhage combined with displacement of the presenting part, there were 7 cases of placenta praevia.

Instability of fetal lie is another indication for placentography. The authors had 21 such cases, of which 10 showed placenta praevia. In 27 cases where the presenting part, either vertex or breech, was unexpectedly above the pelvic brim, placenta praevia was found in 3.

The authors' accuracy rate in diagnosing placenta praevia with placentography was 94 per cent. This correlates well with other reported series. Most difficulties occur in determining the exact lower edge of the placenta and the precise degree of praevia. Patients with marked hydramnios are unsuitable for placentography. An undiagnosed soft-tissue pelvic tumor is a possible source of error in interpretation of the films, and the obstetrician may have to exclude this clinically.

The radiologic diagnosis of placenta praevia precludes the necessity for vaginal examination under anesthesia and removes the danger of hemorrhage which might result from such examination. The definite diagnosis of praevia also allows a more accurate control of the last weeks of pregnancy.

Three tables.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

THE GENITOURINARY SYSTEM

Unilateral Renal Disease and Hypertension: Use of the Radioactive Diodrast Renogram as a Screening Test. Chester C. Winter. J. Urol. **78**: 107–116, August 1957. (VA Center, Los Angeles, Calif.)

Forty-four hypertensive patients were studied following an intravenous dose of 1 μc of Diodrast-I^{131} per 5 kg. of body weight. Continuous external measurements of the changing radioactivity over the costovertebral areas were carried out with gamma-ray scintillators and Esterline-Angus recorders. The first spike in the chart, representing the flooding of the kidney vessels with the radioactive medium, was interpreted as an index of the capacity of the renal vasculature. A secondary rise in the curve, some three minutes later, indicates the status of tubular cell secretory function, though it may occasionally be modified by urinary stasis. The final decline in the tracing is normally an index of the ability of the kidney to evacuate urine, but this drop in the graph may also be delayed by urinary stasis or, less often, by tubular cell dysfunction.

In 10 cases the renogram was abnormal unilaterally, coinciding with an abnormal unilateral excretory urogram in 9 patients. In the remaining patient, the excretory urogram was considered normal. The diseased side was further studied by retrograde urography, aortography, and the various renal function tests. Excellent correlation was found; the most useful single procedure was aortography. The series of 10 cases included 2 of contracted pyelonephritis; 3 of vascular abnormalities; 1 of hydronephrosis due to ureteral stricture and another to ureteral calculus; a partially calcified kidney; agenesis; and surgical absence of the kidney with bladder neck obstructive uropathy. In every case where surgery was performed to relieve the disease, the blood pressure showed an appreciable fall.

In 25 of the 44 hypertensive subjects studied, a bilaterally abnormal renogram was obtained. Excretory urography was done in 20 patients in this group, and all but 3 had impaired function. These three exceptions were all in the seventh decade. This is considered of interest in view of the fact that it has been shown in previous studies that nonhypertensive individuals in this age group may have apparently normal excretory urograms with definitely abnormal renograms. Also falling in the group with bilaterally abnormal renograms was a child of five and a half years shown to have extensive polycystic disease.

The remaining 9 patients with hypertension had normal renograms bilaterally, these results correlating well with the other modes of study. An examination with Diodrast-I^{131} showing normal function bilaterally would thus tend to eliminate the need for further urological investigation in most circumstances.

The use of the radioactive Diodrast renogram appears to have considerable merit as a rapid, painless, diagnostic screening test in hypertensive patients. If there is unilateral abnormality, a thorough urological work-up, including an aortogram, is usually indicated.

One roentgenogram; 5 renograms; 1 table.

SAUL SCHEFF, M.D.
Boston, Mass.

Opacification of the Renal Pyramids in Intravenous Urography. C. L. Hinkel. Am. J. Roentgenol. **78**: 317–322, August 1957. (George F. Geisinger Memorial Hospital, Danville, Penna.)

The medullary pyramids of human kidneys vary in number from four to eighteen. Each is made up of collecting tubules which coalesce into larger papillary ducts and enter the minor calyx at the apex (known as the renal papillae). An average papilla contains from ten to twenty-four ducts. These are generally straight and about 2 cm. in length, extending outward in a fanlike manner.

Ordinarily, the papillary ducts and the coalescent collecting tubules from which they derive are not visualized during intravenous urography. However, with the use of contrast media which produce dense opacification in the collecting system, structures outside the calyces may sometimes be seen that previously would not have been apparent.

Typically, the opacification is bilateral and involves several pyramids. Brush-like or flame-shaped flares of opacity of variable size extend outward from the minor calyces. This finding is noted in cases where renal con-

centration is especially good and is seen only on films made prior to release of ureteral compression. It tends to be seen repeatedly in certain individuals. Films must be technically excellent for good demonstration.

No clinical significance has been attached to the finding. It is not clear whether there is any relationship to urinary tract disease, either old or recent. The phenomenon is to be differentiated from caliectasis, calyceal diverticulae or ulcers, papillary abscess, and renal calculi.

Eight roentgenograms; 2 diagrams.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

A Case of Renal Failure Following Renal Angiography. K. M. Dormandy, A. M. Joekes, and D. Sutton. Lancet **2**: 18–19, July 6, 1957. (D. S., St. Mary's Hospital, London, England)

A case of temporary renal failure following renal angiography in a woman of forty-two is reported. It is the first such case encountered in a series of some 500 aortographic examinations performed at St. Mary's Hospital (London) during the past five years, and it is only the second case to be recorded in Great Britain. The patient had good renal function as evidenced by intravenous pyelography and other clinical tests. After a preliminary test dose of 5 ml. of 70 per cent diodone, 30 ml. of 70 per cent sodium acetrizoate (Diaginol) was injected and serial films were obtained. Unfortunately the patient breathed slightly during the exposures and a second injection was therefore necessary, this time of 25 ml. of 70 per cent sodium acetrizoate. These three injections were made at intervals of about ten minutes. The roentgenograms showed unusually good filling of the renal arteries, particularly the right. The left kidney was excreting contrast medium in good concentration into the renal pelvis at the time of the last injection, whereas little evidence of excretion was visible on the right.

The following day, the patient's temperature rose to 100° F., and she passed only small amounts of urine morning and evening. The urine deposit contained many pigmented granular casts and red cells. Next day, urine excretion was down to 11 ml. per hour. The specific gravity of the 200 ml. passed in the twenty-four hours was 1.014. Both kidneys were easily palpable and tender. The temperature returned to normal by the fifth day. On the eighth day an extra waterload of 800 ml. was given and excreted normally, 100 per cent in four hours. The kidneys gradually became smaller and were no longer palpable when the patient was discharged from the hospital.

As a result of this experience, the authors have reduced the dose per injection to a maximum of 20 ml. of 70 per cent diodone or 70 per cent sodium acetrizoate, whenever a high proportion of the test dose enters the renal arteries. Only in exceptional cases, and where renal function is good, are second injections made, and the maximum dose is then cut down to 15 ml. Lower concentrations of contrast media are also being used, by mixing them in various proportions with the newer less toxic media, such as Urografin or Hypaque 45.

Two roentgenograms; 1 chart.

Acute Renal Failure After Aortography. A. D. Roy. Lancet **2**: 16–17, July 6, 1957. (Radcliffe Infirmary, Oxford, England)

A case of severe renal damage following aortography is reported. The patient was a 36-year-old man, who had been free of urinary symptoms until 1946, when he had an episode of urinary infection with frequency, dysuria, and hematuria. This cleared in about ten days under treatment. A urinary investigation was carried out in 1956 in connection with an examination for Civil Service. The blood urea level was 26 mg. per 100 ml.; urine was sterile. Intravenous pyelography revealed "no excretion on the right side; slight dilatation of the left pelvis." Right retrograde pyelography showed that "there might be a pelviureteric obstruction with associated hydronephrosis." On aortography, the right renal artery was seen to be small and atrophic. In the nephrographic phase, some small rims of functioning tissue were visualized. The appearance was that of a large hydronephrosis. In this phase, also, the left kidney was well shown. The risk of renal damage was considered at this time but its severity was not foreseen.

A large hydronephrotic right kidney was removed uneventfully. Postoperatively the output of urine decreased until, on the sixth day after aortography, only 3 oz. was passed. The urine contained large amounts of protein; the specific gravity was 1.010; the concentration of urea was 1 per cent. The blood urea level rose to 326 mg. per 100 ml. An intravenous infusion of 50 per cent glucose into a peripheral vein was begun and ran without trouble for six and a half days. The blood urea level continued to rise, reaching a maximum of 459 mg. per 100 ml. on the fourteenth day; by the twenty-sixth day it had fallen to 42 mg. per 100 ml., though the patient was still passing large quantities of dilute urine. The blood pressure did not go above 156/80 Hg at any time. Four months following aortography, the blood urea level was 34 mg. per 100 ml.; a urine concentration test did not produce urine with a specific gravity above 1.016.

The author believes that the renal damage must have been due to the aortographic procedure, because cortical necrosis was already present in the kidney removed at operation. The nephrectomy prejudiced the patient by its effect on protein breakdown, and the blood urea probably would not have risen to such an extent otherwise, but the nephrectomy did not cause the renal damage. In every way the technic of the examination and the dosage of contrast medium were well within the limits regarded as safe. However, the nonfunctioning right kidney had a very reduced blood supply, and the left kidney probably received a relatively higher dosage of the contrast medium.

When only one kidney is functioning, it is recommended that the dosage of contrast medium be reduced. Any operation on the renal tract should be delayed for at least seven days after aortography to exclude the possibility of renal damage. Such damage is due to an acute cortical necrosis caused by injection of organic iodide.

Intravenous infusion of 50 per cent glucose into a peripheral vein is preferred to an intragastric drip for the treatment of the renal failure.

Two roentgenograms; 1 photomicrograph; 1 graph.

Primary Carcinoma of the Ureter Complicated by Ureteritis Cystica. A Case Report. Lewis G. Jacobs. Stanford M. Bull. **15**: 170–173, August 1957. (VA Hospital, Oakland 12, Calif.)

The author reports the case of a 70-year-old man hospitalized for repair of a hernia. Urinalysis showed

an occasional erythrocyte and retrograde pyelography demonstrated a filling defect in the left lower ureter, found on operation to be due to a tumor. Following ureteronephrectomy the patient survived over seven years in spite of cardiac disease and prostatism. The resected specimen showed papillary transitional-cell carcinoma of the ureter, ureteritis cystica, and marked epithelial metaplasia.

One roentgenogram; 1 photograph; 2 photomicrographs. AUTHOR'S ABSTRACT

A New Method for Radiographic Demonstration of the Bladder and Its Pathologic Contents. G. Graas and H. Miller. Fortschr. a. d. Geb. d. Röntgenstrahlen **87:** 218–221, August 1957. (In German) (G. G., Christophstrasse 1, Göppingen, Germany)

The difficulty of obtaining satisfactory delineation of mucosal relief in the urinary bladder has been largely overcome by the use of a new medium, Endografin Fl, a 50 per cent aqueous solution of 3-amino,2,4,6-triiodobenzoic acid, in the form of the methylglucamine salt.

The bladder is emptied by catheterization, with external manual pressure, and 10 c.c. of Endografin, with 2 c.c. of air, is instilled through the catheter. An even distribution of the medium over the mucosa is insured by gentle massage, and any remaining is drained, following which ample amounts of air are introduced.

By this means, satisfactory double-contrast cystograms have been obtained, with demonstration of calculi, foreign bodies, benign and malignant neoplasms, and diverticula. Since diverticula are commonly located posteriorly or posterolaterally, they are best shown with the patient prone.

Four cystograms.

Experiences with Thixokon: An Aqueous, Thixotropic Urethrographic Medium. Joseph J. Kaufman. J. Urol. **78:** 188–191, August 1957. (Wadsworth VA Hospital, Los Angeles, Calif.)

Thixokon is a solution of sodium acetrizoate (3-acetamido-2,4,6-triiodobenzoic acid) to which there has been added a nongelling starch, amioca, containing nearly 100 per cent amylopectin. The iodine content is 65.8 per cent. The addition of the starch not only provides an immediate increase in viscosity but imparts a thixotropic property, so that the medium becomes more viscous upon coming to rest in the urethral canal and is thus readily retained during the examination.

Thixokon gives good contrast in retrograde and voiding urethrocystography, permitting excellent visualization of minor filling defects. It is sensitive to strong daylight but is not appreciably affected by artificial illumination. Toxicity studies in animals and man have proved it to be safe, when used with proper precautions in allergic patients. Even when forced into the general circulation *via* the periurethral veins in amounts sufficient to produce pyelograms, it causes no untoward effects. The author's experience includes 175 examinations with no unfavorable effects other than a mild evanescent urethral irritation.

Diluted with equal parts of sterile distilled water, Thixokon has provided good antegrade visualization of the vasa, seminal vesicles, and ejaculatory ducts.

Six roentgenograms. SAUL SCHEFF, M.D.
Boston, Mass.

TECHNIC

A Simple Method of Catheterization of the Spleen and Liver. Sven Ivar Seldinger. Acta radiol. **48:** 93–96, August 1957. (Karolinska Sjukhuset, Stockholm 60, Sweden)

A simple technic employing polyethylene tubing fitted over a puncture needle has been developed for the injection of contrast media in lienoportal venography. The author regularly uses this method and has encountered no complications. Polyethylene tubing with a bore slightly larger than an ordinary puncture needle is slipped over the entire length of the needle. The free end of the tubing is stretched so that the diameter and wall thickness become considerably reduced. Detailed instructions as to exact technic of construction and subsequent injection are given.

This method is used in order to avoid damage to the spleen by the needle during respiration or movement of the patient. Insertion is performed during a period of apnea with fluoroscopy as an aid if necessary. The needle is removed; pressure studies and subsequent injections can then be made, moving the patient, if necessary, without undue haste. The instrument has also been used in a series of percutaneous transhepatic cholangiographies.

Two roentgenograms; 1 photograph; 1 drawing.
CAPT. NEIL E. CROW
Parks AFB, Calif.

Simultaneous Roentgen Exposure in the Diagnosis of Traumatic Conditions. P. Ott and J. Güldenberg. Fortschr. a. d. Geb. d. Röntgenstrahlen **87:** 214–218, August 1957. (In German) (Städt. Krankenanstalten, Mannheim, Germany)

In traumatic conditions the taking of two roentgenograms at a right angle to each other results in saving of valuable time. It also prevents pain arising from repeated positioning of injured body parts. This is of importance, especially in the presence of shock. The method has already been applied to cerebral angiography and angiocardiography.

Two separate roentgen tubes are necessary. With the aid of a potentiometer, built into the control mechanism, the milliamperage of each tube can be regulated independently. When the patient is in recumbent position on the roentgen table, the tube above the table requires more output for the anteroposterior view of the skull than does the tube at the side of the table for the lateral view. Conversely, for roentgenography of the lumbar spine, the tube above the table requires less output than the tube at the side. Variation in the speed of intensifying screens, of the focus-film distance, and use of a thin copper filter on one of the cassettes can also compensate for the variation in thickness of body parts to be penetrated.

Stray radiation resulting from the simultaneous exposures represents a disadvantage of the method. A special diaphragm, however, built into the grid table and a second identical diaphragm perpendicular to the first and to the plane of the table, at the film margin nearest the tube, have eliminated this disturbing factor.

Anteroposterior and lateral views of the skull, as well as of the lumbar spine, are reproduced to illustrate the adequacy of the method.

ERNEST KRAFT, M.D.
Northport, N. Y.

An Efficient and Simple Cassette-Changing Device for Angiocardiography. Robert H. Goetz. Angiology **8**: 255–258, June 1957. (Groote Schuur Hospital, Cape Town, Union of South Africa)

A cassette-changing device is described which the author has found to be "foolproof, easy to handle, and cheap in manufacture." No originality is claimed for the principle of the device, but various details such as the extremely simple method of discharging the exposed cassettes, the lack of moving parts, and a ratchet attached at the side of the apparatus, make for simplicity and efficiency of operation. It is these features that are considered to be new.

Diagrams are reproduced which show the constructional principle. Two types have been in use—one hand-operated and the other motor-driven. The speed is limited, but with some experience three exposures within two seconds can readily be taken with the hand-operated model; the motor-driven model permits two exposures per second.

Three diagrams; 1 photograph.

MISCELLANEOUS

A Radiological Classification of Diseases. M. Simon. Brit. J. Radiol. **30**: 439–442, August 1957. (Guy's Hospital, London, S. E. 1, England)

If one considers any radiologic diagnosis, *e.g.*, a sigmoid colon carcinoma, with obstruction, it is obvious that it consists of an anatomical, an etiological, and a radiological component, each specified as completely as possible. In this example it is implied that each of the three components has been primarily subdivided to indicate alimentary tract, growth, and resultant structural change, respectively, and secondarily subdivided to provide colon, malignant growth and mechanical alteration. In the final diagnosis each of these has then been further divided to specify sigmoid colon, carcinoma, and obstruction. It would be adequate, however, to use only the primary and secondary divisions of each component classifying the case simply as malignant growth of the colon with secondary mechanical effect.

A classification based on this principle is presented.

RADIOTHERAPY

Cancer of the Gingiva. Sam A. Wilkins, Jr., and William R. Vogler. Surg., Gynec. & Obst. **105**: 145–152, August 1957. (Emory University School of Medicine, Emory University, Ga.)

Of 512 malignant neoplasms of the mouth seen at Emory University School of Medicine, Georgia, between 1937 and 1956, 81 involved the gingiva presumably primarily. The use of tobacco appeared to play an etiologic role; 57 per cent of the males and 64 per cent of the females used it either for smoking, chewing, or snuff dipping (an old Southern custom). Of the 28 females who used tobacco, 22 (79 per cent) used it as snuff. Leukoplakia was present in some portion of the mouth in 40 per cent of the entire group. Kahn tests, obtained in 37 of the patients, were negative.

Treatment was with radiation, surgery, or both. The technic of irradiation is not described other than to say that it was given through both external and oral portals, and by implantation of radon seeds or, rarely, radium. Telecobalt therapy, used during fourteen months of the period in study, did not contribute to the salvage of patients, but seemed to lessen the morbidity incident to treatment.

Of the 81 patients, 72 were treated. Of 30 treated five or more years before this report, 9 were considered as five-year cures, 3 by surgery, 4 by irradiation, and 2 by irradiation followed by surgery. In 1 of the group "cured" by irradiation a recurrence proved fatal nine years later; another had a second primary cancer, of the buccal mucosa, after ten years.

Of 32 patients followed between two and five years 12 were well: 8 following surgery and 4 after irradiation. There were 13 failures after surgery, 3 after irradiation, and 2 after irradiation and surgery combined. Two patients died of other causes. Almost all of the failures in both groups were recognized during the first two years after treatment.

When the lesion was confined to the gingiva, irradiation was as effective as surgery. It was slightly less effective if the lesion had spread to the adjacent areas, and almost of no value in treating regional metastases. Surgery salvages some radiation failures, and *vice versa*. Surgery is the preferred method of therapy when the lesion involves bone or regional nodes.

Four graphs; 6 tables.

MORTIMER R. CAMIEL, M. D.
Brooklyn, N. Y.

Clinical Features and Therapeutic Results in Cancer of the Larynx from 1940 to 1956. Friedhelm Hess and Eberhard Scherer. Strahlentherapie **103**: 535–545, August 1957. (In German) (Strahlenklinik der Philipps-Universität, Marburg, Germany)

Carcinoma of the larynx is relatively rare, constituting only 1 to 3 per cent of all cancers, but is steadily increasing in incidence. Prolonged strain of the voice, smoking, and exposure to dust are the main exciting factors.

The authors' material consists of 117 cases, 107 in males and 10 in females, seen from 1940 until 1956, inclusive. The lymph nodes were involved in 18 per cent. The authors have gained the impression that radiotherapy has its indications as well as surgery, and the following conclusions are reached:

When the tumor is confined to one vocal cord (Stage I), conservative surgery and radiotherapy are equally effective. If radiotherapy fails, successful surgery can still be performed afterward. If, however, primary surgery fails, radiotherapy will be disappointing. It is therefore better to do radiotherapy first and reserve surgery for recurrences. In Stage II the same situation exists; but conservative surgery is no longer possible, while radiotherapy has the advantage of better functional results. A combination of both methods is also indicated in this stage, with radiotherapy applied first and surgery reserved for residual tumor and for recurrences. In Stage III radiotherapy should be tried first, unless primary surgery is necessary for controlling respiratory embarrassment and neoplastic perichondritis. In Stage IV only palliative measures are possible. In surgical cases without preoperative irradiation, the authors recommend postoperative radiotherapy.

For efficient radiotherapy a minimal tumor dose of

4,000 r is required, while the optimal dose is 6,000 r. No advantages are gained from a larger dose either with a stationary roentgen beam or with rotation technic. In addition to high-voltage therapy, encouraging results have been achieved with contact therapy following a fenestration operation. It is urged that competition between the various methods be replaced by a combination of radiotherapy and surgery, well planned and adapted to the individual patient.

Four graphs; 1 drawing; 5 tables.

ERNEST KRAFT, M.D.
Northport, N. Y.

Management of Patients Having Bronchogenic Carcinoma. William W. Saunders. Stanford M. Bull. **15:** 159–163, August 1957. (Stanford University Medical School, San Francisco 15, Calif.)

A statistical report is made on the treatment and results in 319 cases of proved bronchogenic carcinoma seen in the decade 1946-56 at the U. S. Veterans Administration Hospital, San Francisco. General methods of handling, with choices of thoracotomy, resection, radiotherapy, or palliation, were about the same as those in general use. Of the 319 patients, 36 per cent were judged eligible for thoracotomy but in almost one-half of these the tumor proved unresectable upon exposure. Approximately one-third of the cases were handled primarily by radiotherapy without surgery. Seventy-nine of 118 patients so treated received "arresting" or "curative" doses of 3,000 to 6,000 r (tumor dose) with conventional radiation equipment and technics. The remainder of the radiotherapy group were given palliative irradiation with widely varying doses. All other cases (approximately one-third of the total) received less strenuous palliative measures of various nonradiotherapeutic types.

Results are presented in tabular and graph form. It is evident that "curative surgery" offers better results at any point in the follow-up period than does major irradiation, and the latter, in turn, is better than less strenuous noncurative methods. The overall results are very discouraging, as has been recognized from previous series. Only a 10 per cent five-year survival rate was achieved in a group of 40 patients thought to be free of tumor after resection. This is only 1.25 per cent of the whole patient group. The author notes that "if every patient were subjected to resection at a time when visible tumor could be removed, the reduction in five-year mortality would be only from 99 per cent to 90 per cent. The cost of this small reduction [in fatal outcome] would include rather closely spaced medical examinations, roentgen chest films, etc., of the whole population over thirty years of age.

"Neither more radical surgery nor newer methods of radiation seem likely to influence the mortality appreciably." It would appear that the only hope lies in new methods of diagnosis and treatment and that further development of our present methods is unlikely to reduce the mortality to a *major* degree.

Three charts; 2 tables. JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Surgical Treatment of Cancer of the Cervix Recurrent After Previous Radiation Therapy. Alexander Brunschwig and William W. Daniel. Surg., Gynec. & Obst. **105:** 186–190, August 1957. (Memorial Center, New York, N. Y.)

The prognosis of carcinoma of the cervix, recurrent after radiation therapy, is often considered hopeless. However, the authors' experience in treating such patients with surgery would indicate that this attitude should be abandoned. Eighty-four patients with cancer recurrent six months or more after irradiation were operated upon at the Memorial Center for Cancer and Allied Diseases in New York between the latter part of 1947 and 1951.

The patients were treated surgically as if they had had no previous therapy. If the lesion was confined locally to the cervix and its environs, a hysterectomy with pelvic node dissection was done. If a local organ was involved, some type of exenteration was performed. Excluded from the results are those patients in whom only palliative procedures could be done. Of the 72 remaining patients, there were 30 on whom hysterectomy and node dissection was carried out. Of these, 17 (57 per cent) survived five years or more, apparently free from cancer. Of 42 patients on whom some form of exenteration was necessary, 8 (nearly 20 per cent) survived five years or more. There was no operative mortality in the first group; in the second it was 20 per cent. In the entire series, excluding operation for palliation only, the five-year salvage was 25 of the 72 patients (35 per cent).

Patients who have been treated for carcinoma of the cervix should have frequent examinations over a prolonged period since recurrences may still be dealt successfully with by appropriate surgery.

Five tables. MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Cancer of the Ovary: Results of Treatment in 135 Cases. Merrell A. Sisson and L. Henry Garland. Stanford M. Bull. **15:** 191–196, August 1957. (San Francisco Hospital, San Francisco 10, Calif.)

A report is made of five-year end-results in 135 patients with proved primary carcinoma of the ovary managed by surgery and irradiation, or by irradiation alone following biopsy. One hundred fifteen of the cases received "definitive" treatment and are included in the statistical analysis. Clinical staging was made according to Heyman's classification.

Most of the patients were given a single course of roentgen irradiation with conventional voltage technics and large anterior and posterior fields measuring 20 to 35 cm. in diameter to cover the entire abdomen and pelvis. Daily doses ranged from 75 to 200 r in air on one field.

Forty-eight of the 115 treated patients received an initial radiotherapy course delivering estimated midabdominal doses of less than 1,500 rads in three weeks. Only 2 (4 per cent) of these patients survived five years. Sixty-seven patients received midabdominal doses of more than 1,500 rads in three weeks and 25 of these (37 per cent) survived five years. It is noted that in 5 of the "arrested patients" with more than a five-year survival, recurrence subsequently developed and proved fatal. As is to be expected, better survival rates were attained in the earlier stages but not greatly better than in well managed Stage III cases.

A comparison with survival rates reported by other authors is made. There was no reliable correlation of histologic type and radiosensitivity with the survival rate. It appeared that higher doses had a moderately

beneficial effect in improving survival rates when correlated with clinical staging.

It is the authors' feeling that radiogold should be reserved for the unusual or special cases, *i.e.*, those with advanced or recurrent disease with ascites and no large tumor masses, and in which "wide-field roentgen therapy cannot conveniently be given."

An important beneficial effect of radiotherapy in a purely palliative role is well demonstrated in this series.

Conclusions are that early postoperative roentgen therapy to wide fields over the abdomen and pelvis is indicated in all cases of carcinoma of the ovary in which surgical removal is not felt to be complete. A midabdominal dose of approximately 2,500 rads in thirty days is felt to be "a desirable initial minimum average course." Probably heavier treatment is indicated in patients whose tumors are apparently confined to the pelvis. JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Hodgkin's Disease: A Revised Clinical Classification and an Approach to the Treatment of Its Localized Form. Frank A. Brown and Henry S. Kaplan. Stanford M. Bull. **15:** 183–190, August 1957. (Stanford University School of Medicine, San Francisco 15, Calif.)

General clinical and pathological features of Hodgkin's disease are reviewed and treatment methods are summarized. The authors propose a three-stage classification modified from that offered by Peters (Am. J. Roentgenol. **63:** 299, 1950. Abst. in Radiology **56:** 313, 1951) as follows:

Stage I: Involvement of one regional group of lymph nodes.

Stage II: Involvement of two or more *contiguous* regional groups of lymph nodes confined to either the upper or lower trunk.

Stage III: Involvement of two or more noncontiguous regional groups of lymph nodes, intra-abdominal involvement, or generalized symptoms.

It is noted that Stages I and II are localized forms of the disease, while Stage III is generalized. The minor change in classification is in Stage II, where the authors have made an effort to narrow this class slightly and provide a more explicit definition.

A series of 109 histologically proved cases of Hodgkin's disease managed and followed over a minimum of five years is analyzed. Females slightly outnumbered males, at variance with series previously reported. The peak age incidence was twenty-one to thirty years, but with the disease very nearly as common in the thirty one to forty year group.

Survival rates are tabulated and analyzed for each of the three stated clinical stages. Patients with localized disease showed five- and ten-year survival rates of 75 and 43 per cent, respectively. For generalized disease the corresponding figures were 27 and 8 per cent. These results again serve to emphasize the better prognosis in earlier cases and the overall relatively hopeful outlook for Hodgkin's disease. It is evident that the great majority of patients in this series were in the Stage III group.

Since October 1953 the authors have instituted a new specific program for treatment of all cases of localized Hodgkin's disease seen at their institution. Briefly this consists of conventional radiotherapy to cover the involved areas, with delivery of a calculated tumor dose in the range of 3,000 to 3,500 r in about three weeks. Irradiation is followed by administration of nitrogen mustard intravenously in dosages of 0.4 mg. per kilogram body weight. Histories of 6 cases so treated and followed for short periods are briefly summarized. Because of absence of early recurrence, the authors feel that their technic is sufficiently encouraging to warrant additional trial.

Four roentgenograms; 5 tables.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Irradiation in the Treatment of Anovulation. Michael S. Forrest. M. J. Australia **2:** 325–326, Aug. 31, 1957. (The Royal Women's Hospital, Melbourne, Australia)

Anovulation may be confirmed by demonstration of persistence of cervical mucus arborization, by endometrial biopsy with demonstration of proliferative changes without secretory changes, and by basal temperature charts showing typical monophasic patterns. In cases where adequate sterility studies of husband and wife have shown that the only abnormality appears to be anovulation, and in which medical management has been of no avail, radiotherapy may be tried.

The author reports a series of 33 patients receiving a total calculated ovarian dose of 180 r and a pituitary dose of 75 r administered in three divided doses over a period of fourteen days. Therapy was commenced immediately after a normal menstrual period to minimize the possibility of irradiation of an early pregnancy. Subsequent ovulation was demonstrated in 16 patients and 13 of them became pregnant in periods of one to twelve months following irradiation. The total number of pregnancies occurring was 25. Seventeen patients failed to show ovulation and in 1 of these ovarian insufficiency subsequently developed. None of the 25 fetuses demonstrated recognizable evidence of radiation damage.

Dangers of irradiation include the risk of damage to the fetus or to future generations through genetic change, but studies from other series have failed to demonstrate such damage in man. There is apparently also some risk of production of ovarian insufficiency, but this appears small. The authors have, however, decreased their dosage to the ovaries to 50 r in patients treated subsequent to those reported here.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Oxygenation in Radiotherapy. I. Radiobiological Considerations. L. H. Gray. Brit. J. Radiol. **30:** 403–406, August 1957. (Mt. Vernon Hospital, Northwood, Middlesex, England)

The author reviews some of the work done by various experimenters showing a positive correlation between an increased oxygen tension and radiosensitivity of various organisms, tissues, and tumors. He summarizes the radiobiological evidence under five headings, and cites the experimental work supporting his statements:

(1) A great many normal tissue reactions to x and gamma radiation are now known in which radiosensitivity is positively correlated with oxygen availability. This is also known to be true of at least nine animal tumors.

(2) Sensitivity appears in general to be correlated with the availability of oxygen and not with its utilization by the cell.

(3) Cells change their radiosensitivity exceedingly rapidly in response to changes in oxygen tension.

(4) The influence of oxygen on radiosensitivity can be expressed as a numerical ratio of the dose needed to produce a given degree of damage when cells are anoxic to that producing the same effect when they have ample available oxygen.

(5) Because small foci of cells within a tumor may be relatively anoxic, these cells may survive otherwise lethal doses of radiation and be responsible for tumor recurrence. It may be possible to increase the sensitivity of these anoxic foci by increasing the oxygen tension in the tissue to be irradiated.

The author presents a graph to show the relation between increasing tissue sensitivity and increasing oxygen pressure as measured in Ehrlich ascites tumor cells irradiated *in vitro* at 18° C.

Two tables. JAMES E. BAUER, M.D.
Victoria, Texas

Oxygenation in Radiotherapy. II. Clinical Application. I. Churchill-Davidson, C. Sanger, and R. H. Thomlinson. Brit. J. Radiol. **30:** 406–422, August 1957. (I.C-D., St. Thomas's Hospital, London, S.E. 1, England)

This paper opens with the statement that the basis of the use of oxygen in the radiotherapy of cancer is the twofold supposition that there are cells in neoplasms which are protected from irradiation damage by the low oxygen concentration around them, and that this protection can be abolished by increasing the partial pressure of the oxygen respired.

The authors first review the factors affecting the oxygenation of tumor tissue, stating that oxygen concentration around any particular cell will depend on four factors: (1) the coefficient of diffusion of oxygen in tumor tissue; (2) the oxygen tension in that part of the capillary which constitutes the principal source of oxygen to the cell in question; (3) the distance of the cell from the capillary; (4) the respiratory rate of the intervening tumor cells. It is concluded that, of these, the second and third are the most important.

It is shown that the oxygen tension in that part of the capillary supplying the tumor cells may be reduced if capillary blood flow is mechanically slowed, causing a steeper gradient in oxygen depletion of the capillary blood. The authors cite mechanical factors which produce such slowing and state that these are independent of the histologic type of the tumor.

The most practical means at present available for increasing oxygenation of the tumor cells is to raise the partial pressure of the oxygen respired. The authors adapted this principle to the treatment of patients with tumors which were considered incurable by ordinary therapeutic means. They chose a pressure of three atmospheres absolute (30 lb. gauge pressure) of pure oxygen, which seemed about the highest pressure that could be used.

Because of the danger of disturbance of the central nervous system by oxygen at high pressures, the patients were anesthetized prior to being placed entirely within a large pressure tank. After preliminary flushing of the tank with oxygen, a pressure of three atmospheres of pure oxygen was maintained before, during, and after treatment. The pressure was raised gradually and decompression was effected slowly. Bilateral myringotomies are performed and small polyethylene tubes were inserted to avoid rupture of the tympanic membrane by the increased pressure.

As it takes approximately four hours to complete a treatment, including time for anesthesia, compression, and decompression, the usual fractionation in dosage could not be followed. Using a standard 250-kv x-ray therapy unit with filtration to give a half-value layer of 1.7 mm. copper, the authors treated in two fractions with a spacing of one week, aiming to give a total minimum tumor dose of 2,000 r. With this fractionation, the maximum permissible skin dose for adults would appear to be 2,500 to 3,000 r, according to the site and size of the field.

Though the follow-up has been short to date, the authors present their results in 10 cases of carcinoma of the bronchus, 8 cases of carcinoma of the larynx, 11 cases of carcinoma of tongue, tonsil, and pharynx, and 6 cases of tumors of other types. All of the neoplasms were inoperable and there was considered to be little if any chance of cure by conventional radiotherapy.

The results in the 10 patients with bronchial carcinoma are interpreted to indicate that, although the addition of oxygen is likely to produce improvement in the earlier cases, the increase in radiosensitivity is insufficient to make the radical treatment of more advanced cases worthwhile, at any rate until some effective method of combating postirradiation fibrosis is found. The initial results in the treatment of the 8 advanced cases of carcinoma of the larynx are considered encouraging, especially as regards the effect on the lymph node metastases. In the 11 cases of advanced lingual, tonsillar, and pharyngeal carcinoma, also, the authors consider the results to be promising, in view of the effect on both the primary growth and on the secondary metastases. These results they feel are definitely superior to those which might have been expected following conventional radiotherapy. In the miscellaneous group the most interesting feature was the response to irradiation of 2 chondrosarcomas and 1 myxosarcoma, tumors which are usually relatively radioresistant. The response of 2 patients with cerebral tumors was also considered to be encouraging, but it was impossible to draw any definite conclusions from them.

The authors have planned an improved irradiation apparatus which will reduce the time taken to give each treatment to approximately an hour and a half. More than 40 patients have been treated to the date of the report without mishap or complications due to the procedure. It would appear that the treatment of patients under increased oxygen tension has merit, though further trial and follow-up are of course necessary.

Twenty figures, including 2 roentgenograms; 2 tables. JAMES E. BAUER, M.D.
Victoria, Texas

Absorbed Dose—Proposed Experiment for High Energy X-Ray Beams. M. Weissbluth and R. E. Steele. Stanford M. Bull. **15:** 210–214, August 1957. (Stanford University School of Medicine, San Francisco 15, Calif.)

In a theoretical and highly technical article the authors describe a proposed method for the measure-

ment of absorbed dose in ergs per gram, or rads, for an external beam of 4 MVP x-rays. For this purpose a large water phantom is used, large enough to absorb essentially all of the energy of the incident beam. A radiation-sensitive chemical system composed of ferrous sulfate, benzoic acid, and sulfuric acid is enclosed in a small volume in a polyethylene bottle and placed at various points within the water phantom during irradiation. When this chemical system is exposed to radiation, changes will develop in its ultraviolet absorption coefficient which can be observed on a spectrophotometer. Some preliminary data are presented and analyzed. The authors feel that the ferrous sulphate-benzoic acid system offers good possibilities as a calorimetrically calibrated dosimeter for high energy, pulsed x-rays.

One graph; 1 table. JAMES W. BARBER, M.D.
Cheyenne, Wyo.

RADIOISOTOPES

Observations in the Treatment of Hyperthyroidism with I^{131}. Robert E. Beck and Arthur A. Hobbs, Jr. Ann. Int. Med. **47:** 241–247, August 1957. (R. E. B., 600 Mary St., Evansville, Ind.)

One hundred and six patients treated consecutively with I^{131} for hyperthyroidism were studied and it was found that the results in Graves' disease were highly satisfactory. Regression of exophthalmos was superior to that following surgery, and the incidence of complications was much lower. Results in the treatment of nodular goiter were less favorable, and the dosage of I^{131} required for the desired effect was larger. I^{131} was thought useful, however, when surgery was contraindicated.

The dose was calculated by formula, and treatment with a single dose of I^{131}, rather than multiple smaller doses, was preferred. There was no correlation between the size of the dose and the incidence of permanent hypothyroidism.

Transient hypothyroidism was encountered in a significant percentage of cases, but minimal doses of thyroid extract kept the symptoms under control until the gland resumed normal function.

One scintigram; 5 tables.
PAUL W. MATHEWS, JR., M.D.
Bowman Gray School of Medicine

***In Vivo* Measurement of Thyroidal Radioiodine: Effect of "Neck Scatter."** Alan L. Orvis, M. Pierre Koenig, and Charles A. Owen, Jr. J. Clin. Endocrinol. **17:** 966–974, August 1957. (Mayo Clinic, Rochester, Minn.)

The present study was undertaken in an effort to determine whether the variability of scatter in measurements of thyroidal uptake by scintillation counters is of sufficient importance to justify the decrease in counting rate and increase in expense that accompany differential counting methods.

Three variables to be considered in any *in vivo* measurement of radioactive iodine in the thyroid are: (1) neck scatter, (2) self-absorption, (3) distance from the skin to the effective center of irradiation. All three variables are dependent upon the size of the gland, size of the neck, and location of the gland. The increase in counting rate due to scatter in large necks and large glands is somewhat counterbalanced by the decreases produced by self-absorption and the greater distance from the counter to the center of irradiation, providing the counter is equally sensitive to all radiations. Extrathyroidal scatter may be important when the uptake is low and the blood concentration of radioactive iodine is high.

Having obtained measurements of the thyroidal uptake of radioiodine in 140 patients by the simultaneous use of differential and integral counting technics, the authors concluded that the variability of scatter of the rays is of importance only when measurements within the first few hours are desired and when it is necessary to measure small uptakes accurately for special clinical studies. Integral counting without rejection of scattered rays is adequate for routine measurement of thyroidal uptake. In fact, it is to be preferred to differential counting because of greater stability of calibration, and because of the higher counts associated with the integral method, which permits a smaller dose.

Six illustrations. SYDNEY F. THOMAS, M.D.
Palo Alto, Calif.

Thyroidal Uptake of I^{131} After Iopanoic Acid (Telepaque) in 74 Subjects. Letter to Editor. Richard E. Clark and Reginald A. Shipley. J. Clin. Endocrinol. **17:** 1008–1010, August 1957. (VA Hospital, Cleveland, Ohio.)

A study is reported which furnishes a scientific basis for facts that have long been generally appreciated. In 74 euthyroid men the twenty-four-hour thyroidal uptake of I^{131} was determined. These same subjects were then given a 3-gm. dose of Telepaque and tracer studies were done at various intervals thereafter. A severe depression of uptake was evident during the first few days. The recovery rate was initially rapid but decreased after the first week. Restoration of a normal uptake was about 60 per cent complete at thirty days and about 90 per cent at sixty days. The conclusion is that for routine purposes uptake determinations should be postponed to two months after administration of Telepaque.

One graph. SYDNEY F. THOMAS, M.D.
Palo Alto, Calif.

Pathology of Radioisotopic Ablation of the Thyroid in the Dog. Stuart W. Lippincott, Charles G. Lewallen, and Claire J. Shellabarger. Arch. Path. **63:** 540–556, June 1957. (Brookhaven National Laboratory, Upton, L. I., N. Y.)

In conjunction with studies of protein metabolism, the effects of the internal ionization of I^{131} were investigated in mongrel dogs to determine (1) the possible role of the thyroid in this species in the animal's metabolism, (2) the pathology of canine myxedema; (3) whether selective localization of I^{131} might in time result in the production of a neoplasm in the thyroid.

Eight dogs were given a single oral dose of I^{131}, in dosage ranging from 0.063 to 0.98 mc. per kilogram of body weight. Myxedema developed in all of the animals. Clinically, this was characterized by decrease in food consumption, increase in body weight, lethargy, hyperkeratosis and epilation, hyperglobulin-

emia, and hypercholesteremia. Pathologically, atrophy of thyroid follicles resulted in virtually complete ablation of the gland in all dogs. Atrophy of skin and edema of the corium developed. Cellular degeneration occurred in a large part of each anterior pituitary gland. A carcinoma of the thyroid was found in 1 dog, but this probably bore no relation to the treatment, since thyroid cancer did not occur in the other animals.

Twelve photomicrographs, 4 in color; 3 photographs; 3 graphs; 2 tables.

Comparison of Acute Pathological Effects of Alpha- and Beta-Particle Radiation of Rat Thyroid. Stuart W. Lippincott, Claire J. Shellabarger, and Johan K. Basson. Arch. Path. **63:** 557–561, June 1957. (Brookhaven National Laboratory, Upton, L. I., N. Y.)

The acute functional and pathological alterations in the thyroid of the rat were studied after administration of known doses of alpha (At^{211})- and beta-(I^{132})-particle radiation. It was found that functional impairment increased with increments in dosage with both isotopes. The alpha dose gave a larger impairment than the beta dose by a factor of more than 2 in the 30,000–35,000-rep range and less than 2 in the 60,000–70,000-rep range.

Pathologically, the degree of damage to the thyroid was not related to the type of radiation but appeared to be correlated qualitatively and quantitatively in terms of equivalent energy release from the two isotopes. With 525 μc of I^{132} (30,000 rep) occasional stromal edema was noted in the thyroid. With 11 μc of At^{211} (35,000 rep) stromal edema was always present, and with 22 μc of At^{211} (70,000 rep) there was also follicular epithelial degeneration. Administration of 1,050 μc of I^{132} (60,000 rep) resulted in necrosis of all but a peripheral rim of follicles. Total destruction of all follicles occurred after 44 μc of At^{211} (140,000 rep).

Functional and pathological changes were in the same direction, but no complete correlation of the two could be made.

Six illustrations, 4 in color; 2 tables.

Absorption Patterns of Isotope Labeled Dietary Constituents in Postgastrectomy Patients. William C. Shoemaker and Arthur W. Wase. Surg., Gynec. & Obst. **105:** 153–158, August 1957. (Hahnemann Medical College, Philadelphia, Penna.)

An attempt to elucidate the mechanism of postgastrectomy nutritional problems was made by studying the blood absorption pattern of test doses of orally ingested protein and fat labeled with I^{131}.

The protein experiments were initially conducted on 6 dogs and then on 6 patients who had undergone high subtotal gastrectomy with gastroduodenal reconstruction (Billroth I) and on 9 patients in whom high gastrectomy and gastrojejunostomy (Billroth II) had been done. Eleven healthy persons served as controls. Labeled fat experiments were conducted on 23 normal patients and on 15 with Billroth I and on 9 with Billroth II operations.

The following conclusions are reached:

"There was a more rapid appearance of radioactivity in the peripheral blood after oral administration of labelled protein in patients subjected to the Billroth II gastrectomy when compared with normal and Billroth I. This effect was followed by a slightly more rapid falloff in the Billroth II group.

"After administration of labelled fat in both small and large doses, absorption was found to occur earlier in both groups of gastrectomized patients. The levels were appreciably higher in the Billroth I group.

"The effects of by-passing the duodenum after gastrectomy (Billroth II) are the rather sudden emptying of the small gastric remnant into the jejunum and a high initial rise of the absorbed constituent in the blood, but a less complete absorption. This effect is by no means constant or predictable."

Seven graphs. MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Autoradiography and Radioactivity Measurements with Human Neoplasms Containing Radiophosphorus. A. F. Phillips and R. D. Saunders. Acta radiol. **48:** 101–112, August 1957. (Radiotherapeutic Centre, Addenbrooke's Hospital, Cambridge, England)

Radiophosphorus, administered as inorganic phosphate, is taken up preferentially by some types of malignant cells, but the degree of concentration is not high relative to other radiosensitive tissues in the body.

The authors describe methods for measuring radioactivity in human neoplasms, both by an end-window counter and by autoradiographs.

Radioactivity measurements were made in 11 patients with advanced malignant disease who had received P^{32}. In 5 cases the counting was done *in vivo*, and in each case malignant cutaneous lesions contained more radioactivity than the unaffected skin. In 6 cases biopsy material was available and estimates of the differential absorption ratio for malignant tissue could be made.

Autoradiographs were obtained in 5 cases in spite of low levels of radioactivity. The concentration of radioactivity was usually greater in malignant cells than in neighboring nonmalignant tissue, but in 1 case the opposite was true.

The highest mean activity found was 0.6 μc/gm. This would deliver a radiation dose of approximately 360 rad. Such a low dose can be therapeutic only in rare cases. J. P. CHAMPION, M.D.
Grand Rapids, Mich.

The Effect of X Rays upon the Uptake of Phosphorus 32 by the Knee Joint of Six-Week-Old Mice. Modification of the Effect by Pre-Irradiation Intraperitoneal Injection of Cysteamine. C. W. Wilson. Brit. J. Radiol. **30:** 443–444, August 1957. (Westminster Hospital, London, S. W. 1, England)

The author cites the work of several investigators on the protective effect of cysteamine (β-mercaptoethylamine) against some of the biological effects of x-rays. He himself undertook to determine whether or not cysteamine exerts any influence upon radiation-induced depression of the uptake of P^{32} in the knee joint of the mouse. The left hind legs of six-week-old mice were given a dose of 2,000 r of x-rays generated at 200 kvp, with a half-value layer of 1 mm. copper. Immediately afterwards cysteamine was injected intraperitoneally, and directly after this the right hind legs also received 200 r. Four weeks after irradiation, P^{32} was injected intraperitoneally and the animals were sacrificed one to two hours after the injection for measurement of uptake in the knee joints.

The depression of P^{32} uptake in the growing bones by irradiation was found to be less marked in the right

knees, irradiated after injection of cysteamine, than it was in the left knees, irradiated before cysteamine was given. The author states that the protection thus demonstrated indicates that cysteamine is concentrated in certain parts of the bone at least. He suggests that it may be possible to reduce the effect of radiation from bone-seeking radioisotopes by means of repeated doses of cysteamine.

One table. JAMES E. BAUER, M.D.
Victoria, Texas

Incorporation of P^{32} into Mouse Mammary Cancer. Influence of Estrogen and Testosterone. Alois Vasicka and Somers H. Sturgis. Arch. Surg. **74:** 606–609, April 1957. (A. V., City Hospital, Cleveland, Ohio)

Estrogen and testosterone were tested for their ability to modify the incorporation of P^{32} into the total nucleic acids of mouse mammary adenocarcinoma transplants in both male and female castrated C_3H mice. The authors are experienced in this type of investigation and this current study tends to confirm their previous work which deals with similiarly treated transplant tumors, excised and then incubated with P^{32}. The methods are clearly outlined and the results analyzed statistically. Tumors in castrated female mice treated with estrogen showed a 20 per cent increase of P^{32} incorporation into the nucleic acid fraction when compared with controls, and a 25 per cent decrease of this incorporation when treated with testosterone. A reverse trend was recorded in tumors transplanted into castrated males.

Five tables. J. E. RHODENBAUGH, M.D.
The Henry Ford Hospital

Differentiation of Macrocytic Anemias and Diagnosis of Pernicious Anemia and Sprue in Remission by Accelerated Measurement of Hepatic Uptake of Radioactive $Co^{60}B_{12}$. George B. Jerzy Glass and Linn J. Boyd. Ann. Int. Med. **47:** 274–292, August 1957. (G. B. J. G., New York Medical College, Flower & Fifth Ave. Hospitals, New York, N. Y.)

The differential diagnosis of various types of macrocytic anemia often presents difficult clinical problems. Since Castle's intrinsic factor in the stomach is absent in pernicious anemia and well preserved in other macrocytic anemias, a method for determining its presence can offer a means of differentiation. Since intrinsic factor is necessary for the absorption of physiologic amounts of vitamin B_{12} in the intestines, absence of this factor from the stomach impairs intestinal absorption of the vitamin.

Until recently, tests for the presence or absence of intrinsic factor in the stomach required a difficult assay involving repeated counts of reticulocytes and red cells after administration of the tested gastric juice to a patient with pernicious anemia in relapse. Administration of vitamin B_{12} labeled with radioactive cobalt has greatly simplified this task.

The methods currently used are (1) the fecal excretion test; (2) the urinary flushing technic; (3) the measurement of hepatic uptake; (4) determination of radioactivity of the blood serum, all following a tracer dose of this vitamin.

In the present study the authors present a simplified and accelerated modification of the measurement of the hepatic uptake of radioactive B_{12}. Such measurements are based on the premise that B_{12} absorbed in the intestines is ultimately deposited in the liver. There it can be detected with a sensitive scintillation counter by scanning the liver superficially following administration of a tracer dose of radioactive B_{12} labeled with Co^{60}. The uptake usually reaches a peak at the end of the first week following the injection of the oral tracer dose. When a similar dose of radioactive B_{12} is given to patients with pernicious anemia in relapse or remission, none or only traces of the material will be absorbed in the intestine because of the lack of the intrinsic factor, and no radioactive material will be deposited in the liver. However, when a potent concentration of intrinsic factor from hog stomach is added, a large part of the radioactive B_{12} becomes absorbed in the intestine as shown by the appearance of radioactivity over the liver. This pattern is almost pathognomonic of pernicious anemia and is imitated only by patients after total gastrectomy.

In sprue there is also defective absorption of vitamin B_{12} from the intestine, but in contrast to pernicious anemia this defective absorption could not be corrected by the addition of intrinsic factor preparation. Since $Co^{60}B_{12}$ remaining in the intestine will interfere with the determination over the liver, in the original technic a period of five to seven days had to elapse after administration of tracer dose of radioactive B_{12}. Recently the authors have accelerated the procedure by the removal of the unabsorbed $Co^{60}B_{12}$ from the intestine by the administration of a cathartic and enema. This expedient allows one to take the counts as early as forty-eight hours after the administration of the tracer dose, even though they have not as yet reached the peak values.

The case material in this study includes 50 patients, 20 with pernicious anemia (10 in relapse and 10 in complete hematologic remission), 6 with sprue, and 12 who had other nonpernicious macrocytic anemias. Twelve patients had anacidity refractory to histamine. Typical results were obtained before and after the administration of intrinsic factor.

Three charts. I. MESCHAN, M.D.
Bowman Gray School of Medicine

Studies of $B_{12}Co^{60}$ Absorption in Malabsorption Syndrome: Results Before and During Specific Therapy. John W. Frost, Manfred I. Goldwein, and Barre D. Kaufman. Ann. Int. Med. **47:** 293–299, August 1957. (J. W. F., 3400 Spruce St., Philadelphia 4, Penna.)

The malabsorption syndrome can be defined as a disorder resulting from a defect in the intestinal absorption of various substances, including protein, fat, vitamins, and minerals. The syndrome is a manifestation of various gastrointestinal disorders, such as sprue, regional enteritis, intestinal strictures and anastomoses, hypogammaglobulinemia, and pancreatic dysfunction. Variability in the extent of the absorptive defect is often encountered. Relapses and remissions are common.

The relative simplicity of the technics for determining absorption of radioactive vitamin B_{12} offers an ideal method for assaying the multiple absorptive defects common in the syndrome. Reports in the literature would indicate that patients with sprue, severe regional enteritis, and blind loop syndrome show impairment of vitamin B_{12} absorption that is not correctable by the oral administration of a potent intrinsic factor.

This study was done in an attempt to test the validity of the Schilling test as a means of diagnosing the malabsorption syndrome and evaluating the procedure as an objective criterion of effective therapy.

A modified Schilling test was used, employing 0.2 to 0.3 μg. of vitamin $B_{12}Co^{60}$ with an activity of approximately 1.0 μc per microgram. A "flushing" dose of 1 mg. vitamin B_{12} was given intramuscularly simultaneously with the oral dose of radioactive B_{12}. Two hundred fifty cubic centimeter aliquots of 24-hour urines were concentrated and counted in duplicate in a well-type scintillation counter.

Patients were studied before therapy and restudied after treatment was under way. Prednisone, tetracycline, and full doses of potent intrinsic factor were employed.

The mean 24-hour urinary excretion in 30 normal patients was 18.6 per cent, with a standard deviation 5.5. Patients with pernicious anemia showed a mean urinary excretion of 0.63 per cent, with a standard deviation of 0.57, which, after simultaneous administration of intrinsic factor, rose to a mean of 15 per cent, with a standard deviation 3.4.

A test was performed on 5 patients with sprue. Three of these showed impaired absorption while 2 were in the normal range. There was no correlation between the degree of clinical improvement or the radiological appearance of the small intestine with B_{12} absorption. The vitamin B_{12} absorption increased to the normal in one instance with the administration of 1.75 gm. of tetracycline.

Two patients with agammaglobulinemia were studied. One had a normal vitamin B_{12} absorption and the other had a decreased absorption.

Two patients with blind loop syndrome showed consistently low absorption of vitamin B_{12}, which did not respond to cortisone, intrinsic factor, or tetracycline therapy.

Four patients with symptomatic regional enteritis and 1 patient with subtotal gastrectomy showed normal B_{12} absorption. Low absorption of B_{12} was demonstrated in 1 patient with subtotal gastric resection and in another who was studied after resection of all but one foot of small intestine because of superior mesenteric arterial thrombosis. Consistently low absorption was also demonstrated in a patient with cystic fibrosis of the pancreas.

The authors believe that the vitamin B_{12} absorption test is not a diagnostic test of the malabsorption syndrome. Patients with decreased absorption of vitamin B_{12} prior to specific therapy did not consistently demonstrate increased absorption while on therapy, although clinical improvement may occur.

Four charts.

JAMES F. MARTIN, M.D.
Bowman Gray School of Medicine

Cancerogenic Effects of Ca^{45} and Sr^{89} in Sprague-Dawley Rats. Joseph F. Kuzma and Gloria Zander. Arch. Path. **63:** 198–206, March 1957. (Marquette University School of Medicine, 561 North 15th St., Milwaukee 3, Wisc.)

The present investigation was designed to study the long-term cancerogenic effects of Sr^{89} and Ca^{45} in rats allowed to live out their normal life span. It had already been shown that bone tumors could be produced by Ca^{45} and Sr^{89} in mice (Arch. Path. **62:** 262, 1956. Abst. in Radiology **69:** 794, 1957) and by Sr^{90} in rats (Arch. Path. **62:** 433, 1956. Abst. in Radiology **69:** 793, 1957) by intraperitoneal injection, but no data had been published concerning bone-tumor production by Ca^{45} in the rat.

In experiments carried out by the authors, Ca^{45} and Sr^{89} produced malignant bone tumors in the rat after intraperitoneal administration (10 daily or 10 monthly injections). Sr^{89} proved the more effective of the two. These tumors were osteogenic sarcomas, in varying degrees of differentiation. The majority were found in the distal end of the femur and the proximal end of the tibia. Only Ca^{45} produced tumors of the spine and pelvis.

Ca^{45}- and Sr^{89}-induced osteogenic sarcoma are related to radiation injury-repair-neoplasia and appear chiefly at the ends of long bones, where growth activity and concentration of the isotope are greatest.

Benign bone tumors, *i.e.*, exostoses, occurred in 1 rat receiving Sr^{89} and in 6 receiving Ca^{45}, appearing usually in the smaller bones of the extremities, notably the foot.

In 7 Sr^{89} rats, snout soft-tissue tumors developed. All of these were squamous-cell carcinomas. None occurred in Ca^{45} animals.

No benign or malignant bone tumors developed in control rats.

Eight tables.

RADIATION EFFECTS: PROTECTION

Radiation Induced Cancer in Man. Stanford Cade. Brit. J. Radiol. **30:** 393–402, August 1957. (Westminster Hospital, London, S. W. 1, England)

The author briefly summarizes the history of radiation-induced cancer in man, subdividing it into two general periods. The first he characterizes as occupational, in that the persons affected were those whose work was concerned with the new science of radiology—doctors, scientists, nurses, and technicians. In this group he places also the cancer of the pitchblende miners of Joachimsthal and Schneeburg and the bone sarcomas occurring in radium watch-dial painters.

The second period of radiation-induced cancer is designated the era of "therapeutic radiation cancer." The author states that a survey of the world literature reveals less than 300 such cases. He summarizes some of the more important reports from 1907 through 1954, and adds an additional 34 cases.

Of these 34 cases, 20 are basal-cell, basi-squamous, or squamous-cell carcinomas of the skin, 5 squamous-cell carcinomas of the upper air and food passages, and 9 sarcomas of either soft tissue or bone. A brief report of each of the 34 cases is given, specifying the condition for which the patient was treated, the age at treatment, the location and type of the subsequent cancer, and the interval between radiation and the development of the tumor.

Analyzing these cases, the author makes four main points: (1) The majority of the cases were submitted to radiation for benign conditions; only 4 patients in this series were originally treated for cancer. (2) The latent period between exposure to radiation and the development of cancer ranged from

eight to fifty-six years. (3) Cancer developed exactly at the site which was severely damaged by radiation. (4) Both carcinoma and sarcoma can be radiation-induced.

Though it appears that both of the two periods of radiation-induced cancer described are on the wane, the author warns that we may be on the threshold of a third period, where diagnostic as well as therapeutic radiation by megavoltage apparatus and by isotopes may result in a further increase in cancer incidence. Though he encourages further research to diminish the hazards of the medical uses of radiation, he makes the practical and sensible observation that to abolish all risks at the expense of effective treatment and accurate diagnosis would be a self-destroying policy.

Five roentgenograms; 15 photographs.

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Post-Irradiation Infarction of the Femoral Head. Eric Samuel. South African M. J. **31:** 841–842, Aug. 24, 1957. (Johannesburg, Union of South Africa)

The author reports a case of localized infarction of the femoral head resulting from heavy irradiation unavoidably delivered to this structure in the treatment of a metastatic deposit in an adjoining bone. The patient, a 51-year-old woman, was seen seven years following a thyroid operation, complaining of pain in the right hip with some limitation of motion. Roentgen examination showed damage to the right ischial bone, with extensive destruction of the ascending ramus of that bone as far as the acetabulum. The bony architecture of the head and neck of the femoral shaft was normal. A radioactive iodine study revealed an increased uptake over the lesion, which was considered to be a metastatic deposit from a malignant thyroid tumor. Between Jan. 11 and Feb. 25, 1955, deep x-ray therapy (220 kv., with a Thoraeus filter) was administered for a total tumor dose of approximately 5,000 r. Partial, but not complete, relief of pain was achieved. On April 5, a roentgenogram of the right hip joint revealed some slight reformation of bone within the deposit, but in the ascending ramus of the ischium little regeneration of the new bone had occurred.

In view of continuing symptoms, a second course of x-ray therapy was delivered for a tumor dose of 2,864 r. A therapeutic dose of 50 mc. I^{131} was also given. The patient remained relatively free of pain, but still suffered from some limitation of movement of the hip. A roentgenogram on August 27 showed a collapse of the articular surface of the femoral head with a loose separated fragment of bone similar to an osteochondrosis dissecans affecting more than one-third of the femoral head. No history of trauma was obtained. A review of the films taken on April 5 disclosed that the portion of the femoral head showed an increase in density, suggesting an aseptic necrosis—a feature not appreciated at the time of the examination. The mechanism of the infarction is discussed.

Three roentgenograms.

Growth Inhibition of the Lens of the Irradiated Rabbit's Eye. E. Krokowski and U. Ehling. Fortschr. a. d. Geb. d. Röntgenstrahlen **87:** 222–225, August 1957. (E. K., Strahleninstitut der Freien Universität, Spandauer Damm 130, Berlin-Charlottenburg, Germany)

In an earlier report (Ehling and Krokowski: Fortschr. a. d. Geb. d. Röntgenstrahlen **86:** 469, 1957. Abst. in Radiology **70:** 309, 1958) the authors described an investigation of the dependence of roentgen injury to the rabbit's eye upon the dose and quality of radiation. When the damaged eyes of the animals were removed, it was found that in every instance there was interference with growth of the lens, regardless of the dose employed. Amounts of radiation too small to produce clouding still resulted in growth retardation.

Histologic studies showed the germinative layer of the growing lens to be highly radiosensitive. With suppression of mitosis by irradiation, normal development of the lens was no longer possible.

In view of these results, it is suggested that roentgen examination of the head and face in infants may not be wholly without danger to the eye.

Three figures; 1 table.

Dose Reduction in Diagnostic Radiology. G. M. Ardran. Brit. J. Radiol. **30:** 436–438, August 1957. (Nuffield Institute for Medical Research, Oxford, England)

The author reviews recent estimates of the total population dose of radiation from diagnostic procedures in Britain and the United States, and concludes that the figure is probably between 100 and 200 per cent of natural background radiation. Various reports are cited which indicate that it would seem imperative to reduce the dose from this source to the minimum possible in the minimum time.

Some of the principal methods for dose reduction and important factors which must be borne in mind are listed in this article. Mention is made of one of the most important but poorly publicized means of reducing the total radiation dose to the population, namely, elimination of unnecessary radiographic and fluoroscopic exposures. The author also reminds us that much of the dose-sparing effect of high-kilovoltage technic may be nullified if a high-ratio grid is required for maximum radiographic efficiency. Several combinations of films and screens are compared as to their relative exposure requirements and skin dose characteristics.

One table.

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Unnecessary Irradiation in Chest Radiography. W. G. Clarke. Lancet **2:** 316–317, Aug. 17, 1957. (M. R. C. Pneumoconiosis Research Unit, Llandough Hospital, Penarth, Glamorgan, Wales)

Bromide paper (3 × 3 ft.) coated with x-ray emulsion was used to demonstrate the effect of cone size and shape on the area of the body exposed to primary radiation during routine chest radiography. It was found that a 1.5-inch square diaphragm at the base of the cone reduces the radiation to the gonads in the male to about one-seventh (0.1 mr) of that received when a standard 2.5-inch circular diaphragm is used, and it halves the direct skin radiation.

An adjustable, easily movable, protective screen has been found useful for reducing still further the gonad dose during chest radiography and other x-ray examinations and for protecting an operator during fluoroscopy.

Three roentgenograms; 2 photographs.

Concerning the Gonadal Dose in the Diagnostic and Therapeutic Application of Ionizing Rays. Hanns-Joachim Lössl. Strahlentherapie **103**: 614–619, August 1957. (In German) (Strahleninstitut der Städt. Krankenanstalten, Nürnberg, Germany)

In view of the ever increasing significance of the gonadal dose, monitoring of male and female sex organs has been undertaken under various conditions. The results are tabulated for fluoroscopy of small children, radium therapy of hemangioma in infants, and radioisotope therapy. For minimizing the gonadal dose the following recommendations are made:

1. Diagnostic application of roentgen rays should be done only under the supervision of well trained physicians on strict indications and with necessary restraint.

2. In children, high-voltage technic with shortened exposure time should be used, especially in colon studies, pyelography, salpingography, and examinations of the spine, at the expense of contrast. In pregnancy, roentgen studies should be avoided whenever possible, and fluoroscopic studies should be replaced by roentgenography.

3. For the treatment of hemangioma, sources of radiation are preferable with a low depth dose and with minimal generation of stray radiation, for example, radioactive yttrium or strontium in place of radium.

4. Patients, while undergoing radium treatment, should be isolated from visitors, especially from young people; also from other patients and as much as possible from nursing personnel. The best protection can be assured when these patients are kept in a separate room. Nursing personnel should not remain in the immediate vicinity of such patients for more than one hour per day and essential care should be shortened as much as possible. No nurses under the age of forty should be used and a frequent rotation of personnel should be assured in these cases.

5. The radiation dose, especially in region of the genitals, should be constantly checked.

Six tables.

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Practical Device to Reduce Radiation Hazard in Urology. Meyer Emanuel and Francis J. O'Connor. J. Urol. **78**: 192–195, August 1957. (VA Center, Togus, Maine)

The authors describe in detail a modified lead-rubber apron hung from the crossbar supporting the x-ray tube, to separate the field of radiation from the operating urologist. At the level of the patient's genitals is a small opening, above which a flap of lead rubber is sewn to overlap it like a trapdoor. This opening will admit such instruments as ureteral catheters and syringe holders. This simple device is economical and quite effective, cutting the radiation to the hands of the urologist by a factor of 10.

Two drawings; 1 photograph.

SAUL SCHEFF, M.D.
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